Bolt Beranek and Newman Inc.

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Air Quality, Noise, and Wind Measurements in Support of the Boston Downtown Crossing Project

K.M. Chng, P.A. Gardner, and M.J. Thorpe

December 1980

Prepared for:
The Boston Redevelopment Authority
and
The U.S. Department of Transportation

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PREFACE

The measurements of ambient air quality, noise, and wind were made in support of the Boston Downtown Crossing Project. The results of these environmental measurements were to be incorporated into a more comprehensive report that was being prepared by Cambridge Systematics for the U.S. Department of Transportation (DOT), Transportation Systems Center. To expedite the integration of the measurement results or the environmental impacts into the comprehensive report, the format and the pagination for the main body of the text were made consistent with the format being used by Cambridge Systematics in their report to DOT. Section 5.5 of this comprehensive report was set aside for the environmental impact results. Consequently, all of the environmental analysis results were grouped into this one section, and the pages were numbered sequentially with a 5.5 prefix. No such constraints were imposed on the appended documents. The appendices were therefore numbered alphabetically in ascending order.

ACKNOWLEDGEMENTS

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SUMMARY

The environmental impact of the Boston Downtown Crossing Project was measured by pre- and postconstruction monitoring of ambient levels of carbon monoxide (CO), oxides of nitrogen (NO_x), and noise. The three sites that were picked for the monitoring were the Post Office Building, Arch St., and Winter St.

For the baseline conditions (i.e., 1978 preconstruction stage), no exceedance of the 1-hr CO standard was found. The maximum 1-hr CO concentrations measured range from about 16 parts per million (ppm) at Arch St. to over 26 ppm at Winter St. Both the Post Office and the Winter St. sites, however, recorded violations of the 8-hr CO standard of 9 ppm. At Winter St., for example, the highest 8-hr average was over 15 ppm, and on seven separate occasions, this 8-hr standard was exceeded. These CO results are summarized in Table S.1.

Both nitric oxide (NO) and nitrogen dioxide (NO_2) were measured at the Arch St. site only. No applicable standard exists for NO; this pollutant was monitored because it generally correlates well with diesel emissions from buses and trucks. Maximum 1-hr NO_2 measured under baseline conditions was 0.08 ppm. There is presently no short-term NO_2 standard; however, there is an EPA-proposed standard in the range of 0.25 to 0.50 ppm. The measured NO_2 was well under the range of the proposed standard.

TABLE S.1. MEASURED AMBIENT AIR QUALITY AND NOISE LEVELS IN THE PROJECT AREA, 1978 and 1980.

	Post Office Bldg.		Arch St.		Winter St.	
	1978	1980	1978	1980	1978	1980
Carbon Monoxide						
Max. 1-hr (ppm)	20.2	ND*	15.7	6.4	26.3	12.0
No. of times > std. (35 ppm)	0	ND*	0	0	0	0
Max. 8-hr (ppm)	11.6	ND*	7.4	4.4	15.2	5.0
No. of times > std. (9 ppm)	3.0	ND*	0	0	7.0	0
Nitric Oxide						
Max. 1-hr (ppm)	ND†	ND†	0.140	0.151	ND†	ND†
No. of times > std.**	ND†	ND†	—**	—**	ND†	ND†
Nitrogen Dioxide						
Max. 1-hr (ppm)	ND†	ND†	0.080	0.065	ND†	ND†
No. of times > std. (0.25 to 0.5 ppm)††	ND†	ND†	0	0	ND†	ND†
Noise						
Max. Hourly L_{eq}	77	ND*	81	74	83	76
Max. L_{dn}	75	ND*	74	72	79	75
Weekday Average L_{dn}	71	ND*	72	71	76	73
Weekend Average L_{dn}	71	ND*	69	67	74	70

*The Post Office site was discontinued in 1980, hence there is no data (ND).

†Nitric oxide and nitrogen dioxide (NO_2) were measured only at the Arch St. site.

**No standard.

††1-hr NO_2 standard proposed by EPA is in the range of 0.25 to 0.50 ppm.

Measured noise levels were reported both in terms of hourly L_{eq} and L_{dn}. The hourly L_{eq} is a measure of the average noise energy over a period of 1 hr. The L_{dn}, or the day-night sound level, is a 24-hr equivalent sound level that includes a 10 decibel (dB) penalty for nighttime noise. Under baseline conditions in 1978, the measured maximum hourly L_{eq} ranged from 77 dB at the Post Office to 83 dB at Winter St. The maximum L_{dn} ranged from 74 dB at Arch St. to 79 dB at Winter St. Winter St. was the "noisiest" of the three sites. Although these ambient noise levels are generally high, they are typical of noise levels that are commonly encountered in downtown areas of other large cities.

Postconstruction monitoring was conducted only at Arch St. and Winter St. The Post Office site had to be discontinued because of major construction activities in its immediate vicinity.

With the implementation of the Downtown Crossing Project, very dramatic improvements in both the measured 1-hr and the 8-hr CO concentrations were observed at Winter St. No exceedance of either the 1-hr or the 8-hr standard was found. Compared with the baseline conditions, the maximum 8-hr CO has decreased by over 60% with project implementation. This improvement is attributed to a very large extent to the closing of Winter St. to all motor vehicle traffic. The Arch St. site also showed some improvement in the measured CO levels. The reductions in both the maximum 1-hr and 8-hr CO concentrations appear to be significantly greater than the anticipated

reduction that might be attributed to the mandatory federal program for exhaust emissions control. No exceedance of any CO standard was encountered. The changes in measured CO, before and after project implementation, are summarized in Table S.1.

Measured NO at Arch St. appeared to have gotten worse. This is especially true for the higher hourly NO concentrations that are more typically related to short-term event-oriented episodes such as passing buses or traffic congestion. For lower hourly NO concentrations, which are more indicative of general background conditions, the Arch St. data showed some improvement with project implementation. For NO_2, there appears to be some improvement in the measured hourly levels. During the postconstruction stage, maximum 1-hr NO_2 was 0.065 ppm, which represents a decrease of 19% from the preconstruction level.

The noise environment at Winter St. appeared to have significantly improved with the implementation of the Downtown Crossing Project. As shown in Table S.1, the measured maximum hourly L_{eq} has decreased from 83 to 76 dB, and the maximum L_{dn} has decreased from 79 to 75 dB. In addition to these reductions in the noise levels, the character of the noise at Winter St. has also changed. Under baseline conditions, the noise sources were predominantly motor vehicles. With the project implementation, the noise from the pedestrian mall is made up primarily of human voices and music from small bands of musicians that were frequently observed during the postconstruction

monitoring period. At the Arch St. site, there appears to be a small improvement in the noise level with project implementation. Measured maximum hourly L_{eq} and L_{dn} have decreased by about 7 dB and 2 dB, respectively. However, hourly L_{eq} in the mid-range levels, which are generally associated with potential speech interference under normal voice conditions, have actually increased in frequency of occurrence. Consequently, the overall improvement is not as clearly defined as that encountered at Winter St. The character of the noise at Arch St. — as reflected in the makeup of the noise sources — has not changed significantly with project implementation.

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5.5.1 Introduction

5.5.1.1 Study Objective

The objective of this study is to measure the environmental impact — as manifested in changes in the ambient level of carbon monoxide, oxides of nitrogen, and noise — associated with the changes in motor vehicle traffic due to construction of the Boston Downtown Crossing Project.

5.5.1.2 Scope and Approach

The basic approach was to monitor the selected environmental parameters at the same locations before and after implementation of the Project, and at the same time of the year. A total of four sites was selected for monitoring. The selection was based on a number of considerations, including

- Severity of the existing traffic congestion problem
- Anticipated changes with the implementation of the Project
- Proposed bus routing
- Availability and accessibility of the site.

The location of these sites, the selection criteria, the parameters measured, and the associated instruments deployed are shown in Table 5.5.1. The geographical locations of these sites are shown in Fig. 5.5.1.

The 2-week period in July following the July 4th weekend was chosen for the measurements. The preconstruction or baseline monitoring was

TABLE 5.5.1. INVENTORY OF MONITORING SITES AND MEASURED PARAMETERS.

Site ID No.	Site Description	Selection Criteria	Parameters Measured	Equipment
1	Post Office Cafeteria	Maximum impact from Congestion	CO, Noise, Wind Speed, Wind Direction	NDIR, Ecolyzer, Noise Monitor, Wind Sensor
2	Post Office Roof	Rooftop wind	Wind Speed, Wind Direction	Wind Sensor
3	Arch Street	Maximum Bus Impact	CO, NO/NO_2, Noise Wind Speed, Wind Direction	Ecolyzer, NO_x Monitor, Noise Monitor, Wind Sensor
4	Winter Street	Maximum Reduction in Auto Traffic (Auto-free)	CO, Noise	Ecolyzer, Noise Monitor

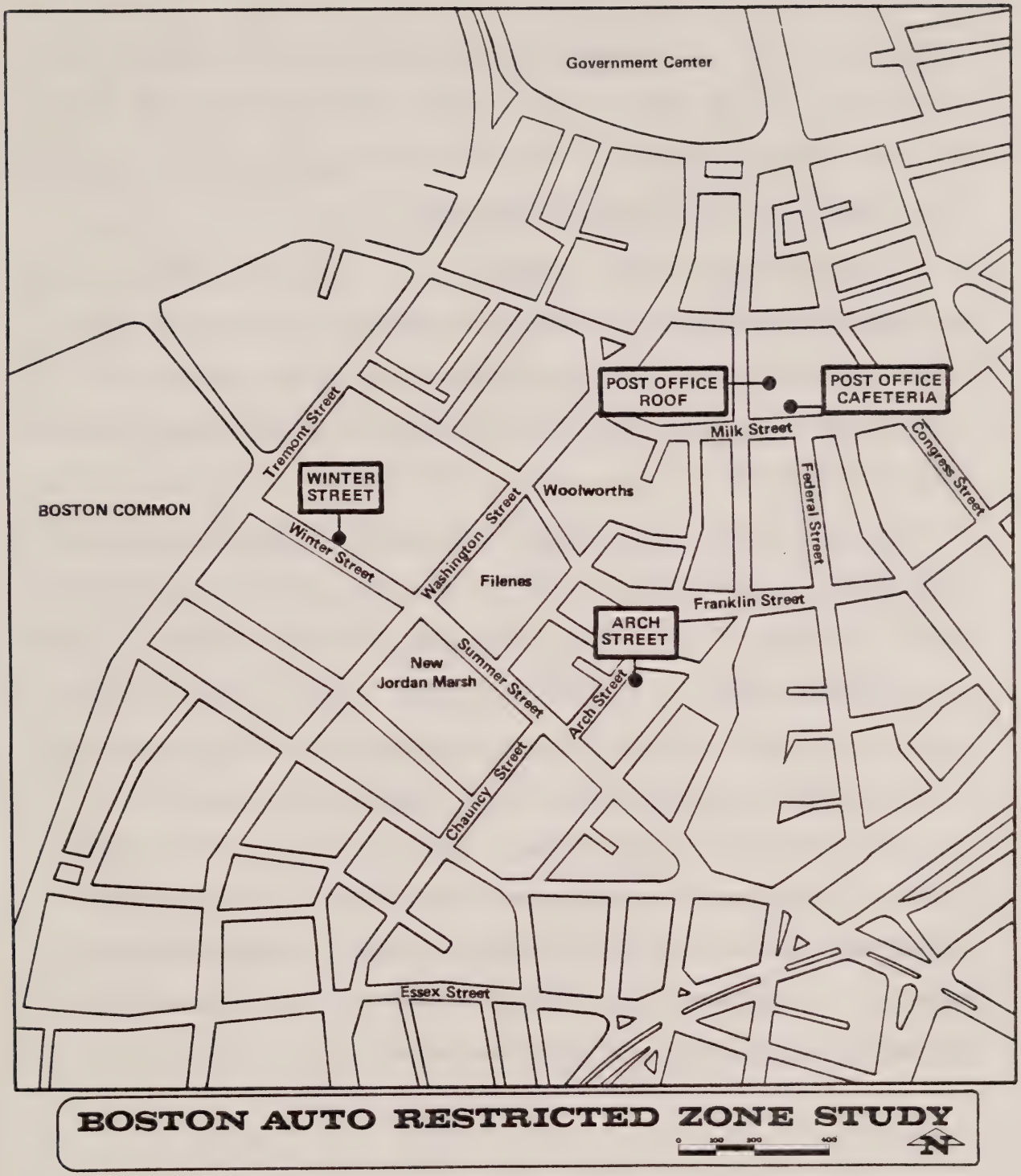

FIG. 5.5.1. GEOGRAPHICAL LOCATIONS OF MEASUREMENT SITES.

conducted in 1978. Postconstruction monitoring was not done until July 1980 because of some delay in construction in 1979. For the 1980 monitoring, the Post Office cafeteria site was discontinued because of ongoing construction activity in the proximity of this site.

Monitoring of all parameters was done on a continuous basis. The data that were recorded on strip charts or on data tape were digitized to produce hourly averages. The reduced data were then screened for validity and then subject to various statistical tests for impact assessment determination.

Section 5.5.2.1 of this report describes the baseline conditions with respect to air quality, noise, and meteorology in the Boston downtown area. The impact of implementing the Downtown Crossing Project on these environmental parameters is discussed in Sec. 5.5.2.2. Detailed supplementary data on the ambient monitoring program and the field measurement results are given in Appendices A and B, respectively. Appendix C contains the results of some of the correlation analyses, and Appendix D provides the technical specifications on the various instruments that were used to measure the environmental parameters. Appendix E shows examples of continuous strip chart records of the various parameters. Appendix F contains tables of digitized data.

5.5.2 Technical Discussion

5.5.2.1 Baseline Conditions

Baseline Ambient Air Quality

Baseline carbon monoxide was measured at three locations — the Post Office, Arch St., and Winter St. A summary of the monitoring results is shown in Table 5.5.2. A nondispersive infrared (NDIR) CO analyzer was used at the Post Office site. Data capture for the NDIR was estimated at 96%. The maximum 1-hr average was 20 parts per million (ppm), which took place at 10 a.m. on Tuesday, July 18, 1978. There was no exceedance of the 1-hr standard of 35 ppm during the monitoring period. The maximum 8-hr concentration was 12 ppm, which was observed at 5 p.m. on Tuesday, July 18, 1978. During this monitoring period, there were three occasions (of nonoverlapping 8-hr time periods) for which the 8-hr standard of 9 ppm was exceeded.

Carbon monoxide was monitored at the Arch St. site with a CO ecolyzer. Data capture was estimated at 65%. The highest 1-hr average CO reading was 16 ppm, which took place at 6 p.m. on Monday, July 17, 1978. There was no exceedance of the 1-hr standard during the monitoring period. The highest 8-hr average CO concentration was about 7.0 ppm, which occurred between noon and 7 p.m. on Monday, July 17, 1978. There was no exceedance of the 8-hr standard during the monitoring period.

TABLE 5.5.2. MEASURED AMBIENT CO, NO_X, AND NOISE IN THE PROJECT AREA FOR BASELINE CONDITIONS.

Site Description	CO				NO_X			Noise			
					NO	NO_2				% of Daytime** 1-hr L_{eq}	
	Max. 1-hr ppm	No. of Times >Std. (35 ppm)	Max. 8-hr ppm	No. of Times >Std. (9 ppm)	NO Max. 1-hr*	NO_2 Max. 1-hr	No. of Times† >Std.	L_{eq} 1-hr Max.	L_{dn} Max.	>66 dB	>72 dB
Post Office Building	20.2	0	11.6	3	NA‡	NA	NA	77	75	68	10
Arch St.	15.7	0	7.4	0	0.14	0.08	0	81	74	48	7
Winter St.	26.3	0	15.2	7	NA	NA	NA	83	79	89	17

*No stds.

†Proposed std. is 0.25 to 0.50 ppm.

**Daytime hours as used in this context are between 7 a.m. and 10 p.m.

‡NA means data not available because this parameter is not measured at this site.

A CO ecolyzer was used to measure concentrations at the Winter St. site. Data capture was estimated at 50%. The maximum 1-hr average CO reading was 26 ppm, which took place at 6 p.m. on Monday, July 17, 1978. There was no exceedance of the 1-hr standard during the monitoring period. The highest 8-hr average concentration was 15 ppm, which occurred between 2 p.m. and 9 p.m. on Monday, July 17, 1978. The 8-hr standard was exceeded on seven occasions during the sampling period.

In summary, CO concentrations at Winter St. were generally higher than at the Post Office and at Arch St. No exceedance of the 1-hr standard was found at any of the sites, but the 8-hr standard was exceeded at both the Post Office and at Winter St.

Nitric oxide (NO) and nitrogen dioxide (NO_2) were measured at Arch St. A summary of the monitoring results is shown in Table 5.5.2. Both pollutants were measured by the chemiluminescent method. Data capture for NO was estimated at 92%. The highest 1-hr average concentration for NO was 0.14 ppm, which was recorded at midnight on Monday, July 17, 1978.

The other daily maximum 1-hr concentrations ranged from 0.01 ppm to 0.13 ppm. There is no current or proposed standard for NO with which to compare these concentrations.

Data capture for NO_2 was estimated at 93%. The maximum 1-hr average reading of 0.08 ppm was recorded at 2 p.m. on Tuesday, July 25, 1978. Daily maximum 1-hr concentrations ranged from 0.03 ppm to 0.08 ppm. Short-term NO_2

standards have not been promulgated at this time. However, there is a proposed 1-hr standard, which will be somewhere between 0.25 ppm and 0.50 ppm. Concentrations measured at Arch St. were well below this proposed standard.

Noise

The BBN Model 614 Noise Monitor was used to collect noise data at the Post Office, Arch St., and Winter St. The maximum 1-hr L_{eq} and L_{dn} for each site is listed in Table 5.5.2. The maximum L_{dn} measured at the Post Office site was 75 dB. The L_{dn} for each of the days monitored ranged from 69 dB to 75 dB — the lowest level occurring on a weekend and the highest occurring on a weekday. These measured sound levels are not out of the ordinary for city noise in a downtown major metropolis. The L_{dn} for this type of environment is usually about 75 to 80 dB. The hourly L_{eq} at this site ranged from 55 dBA to 77 dBA. The lowest L_{eq} occurred at 5 a.m. on a Sunday morning, and the peak L_{eq} occurred at 9 a.m. on a Tuesday morning. There are presently no applicable standards for a commercial/retail environment such as the Downtown Crossing. In the absence of a standard, information on noise levels related to outdoor speech interference was used as a measure of impact. This information, which was compiled by EPA,* suggests that for a 1-m separation, about 95% sentence intelligibility" can be

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*"Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," U.S. Environmental Protection Agency, 550/9-74-004, Washington, DC, March 1974.

communicated in a "normal" voice if the steady A-weighted ambient noise level does not exceed 66 dB. A 95% sentence intelligibility means that 95% of the key words in a group of sentences would be correctly understood. Since outdoor environmental noise levels are not steady but typically fluctuate with time, there will be periods within that hour when normal voice conversation at 1-m separation can still be understood with the 95% sentence intelligibility. This is true even when the estimated hourly L_{eq} is greater than 66 dB. For "raised-voice" conversation at the same 1-m separation, the 95% intelligibility cutoff is 72 dB.

Compared with these speech interference "criteria," the hourly L_{eq} at the Post Office site for 68% of the daytime hours was greater than 66 dB. Speech interference, as measured by the 95% intelligibility and normal voice criterion, would be expected. With a raised-voice criterion, the percent of time at which speech interference could be expected is reduced to 10%.

The maximum L_{dn} measured at the Arch St. site was 74 dB. The L_{dn} for each of the days monitored ranged from 68 dB to 74 dB - with the minimum occurring on Sunday and the maximum on Monday. The L_{eq} levels measured ranged from 54 dBA (measured on a Sunday at 5 a.m.) to 81 dBA (measured on a Tuesday at 1 p.m.). For about half of the daytime hours, the hourly L_{eq} was estimated to exceed 66 dB; for 7% of the time, the hourly L_{eq} was estimated to exceed the raised-voice criterion of 72 dB.

Sound level data from the Winter St. site indicated that the L_{dn} ranged from 70 dB to 79 dB. The lowest L_{dn} was on a Sunday, and the highest on a Thursday. The hourly L_{eq} levels ranged from 61 dBA (measured at 6 a.m. on a Sunday) to 83 dBA (measured at 1 p.m. on a Monday). The ambient noise levels were found to be fairly high. For about 90% of the daytime hours, the 66-dB level (for normal voice and 95% intelligibility) was exceeded. Under the raised-voice condition, the measured levels still show that for about 17% of the time, the 72-dB criterion was exceeded.

In summary, the measurement data indicated that the L_{dn} at each site on each day of monitoring exceeded 65 dB. In general, the L_{dn} values did not vary dramatically from day to day. The data further indicated that sound levels on weekends were generally lower than those on weekdays. Finally, the data indicated that the sound levels at the Winter St. site were generally higher than those at the other two sites.

Wind Speed and Wind Direction

Both wind speed and wind direction were monitored on a continuous basis at three locations — the Post Office roof, the Post Office cafeteria, and Arch St. The data capture rate at the Post Office roof was estimated at 68%. Figure 5.5.2 represents the observed frequency data as a wind rose. The predominant wind direction was SSW. Wind speeds ranged from less than 1 mph to maximum speeds of 11 mph. These speeds represent 1-hr average speeds and not transient gusts.

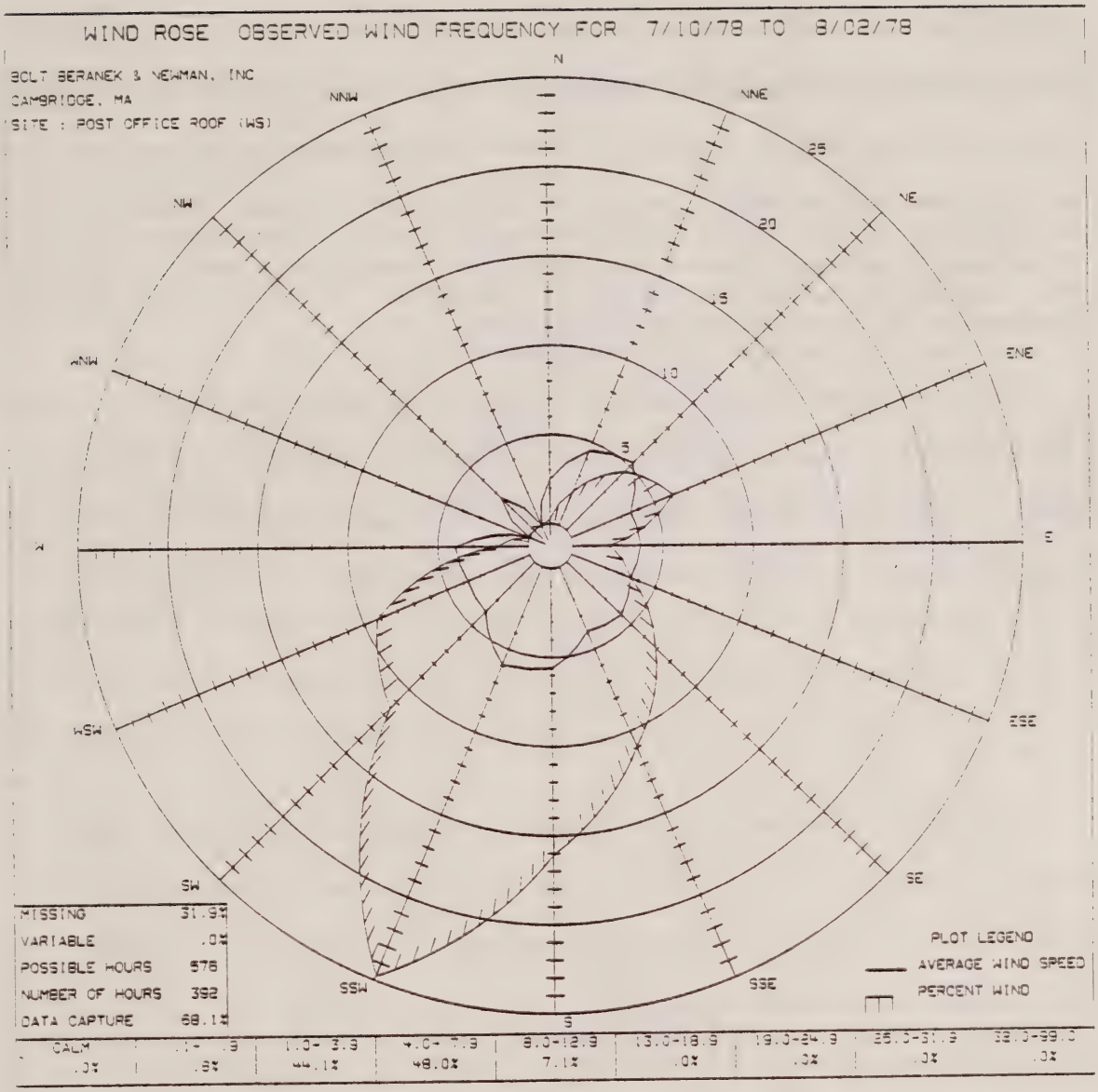


FIG. 5.5.2. WIND FREQUENCY DATA FOR POST OFFICE ROOF SITE.

Wind speed and wind direction were measured at street levels at the Post Office cafeteria. Data capture was estimated at 70%. The highest 1-hr average wind speed recorded was 10 mph. Wind speeds were less than 1 mph for about 10% of the time. Speeds were between 1 mph and 4 mph 36% of the time, and between 4 mph and 8 mph 53% of the time. Speeds between 8 mph and 13 mph were recorded for 1% of the monitoring period. The predominant wind directions were WSW and NNE.

Wind speed and wind direction data were collected at Arch St., with a capture rate estimated at 89%. The highest 1-hr average wind speed recorded was 4.4 mph. Wind speeds between 1 mph and 4 mph accounted for 99% of the time at this site. The predominant wind directions were NNW and SW.

5.5.2.2 Impact of Project Implementation

The impact of the Downtown Crossing is assessed by comparing the measured data on CO, NO_x, and noise for the pre- and the postconstruction periods.

Carbon Monoxide

CO was monitored at three sites in 1978, but the site at the Post Office was discontinued in 1980. Consequently, impact at this site cannot be evaluated at this time because of the absence of postconstruction data.

Arch St. The maximum 1-hr and 8-hr CO measured in 1980 were 6.4 and 4.4 ppm, respectively. No exceedance of either the 1-hr standard of 35 ppm or the 8-hr standard of 9 ppm was encountered. Compared with 1978 results, the maximum 1-hr result in 1980 represents a reduction of about 60% from the corresponding 1978 measurements. Similarly, the 1980 maximum 8-hr CO is only 59% of the corresponding 1978 results.

When the individual hourly CO values are plotted as a frequency distribution, the improvement in ambient CO at the Arch St. site is readily apparent. The frequency distribution of the hourly CO levels for 1978 and 1980 are shown in Fig. 5.5.3. An examination of Fig. 5.5.3 shows that the 98 percentile (i.e., the concentration for which 98% of the time, the measured value will be less than or equal to this stated value) for 1980 is only 5.5 ppm, which represents a 28% reduction from the corresponding 1978 value of 7.6 ppm. Similarly, the 90 and 50 percentiles for 1980 are about 39% and 42% less than the corresponding percentiles for 1978. The reductions in both the

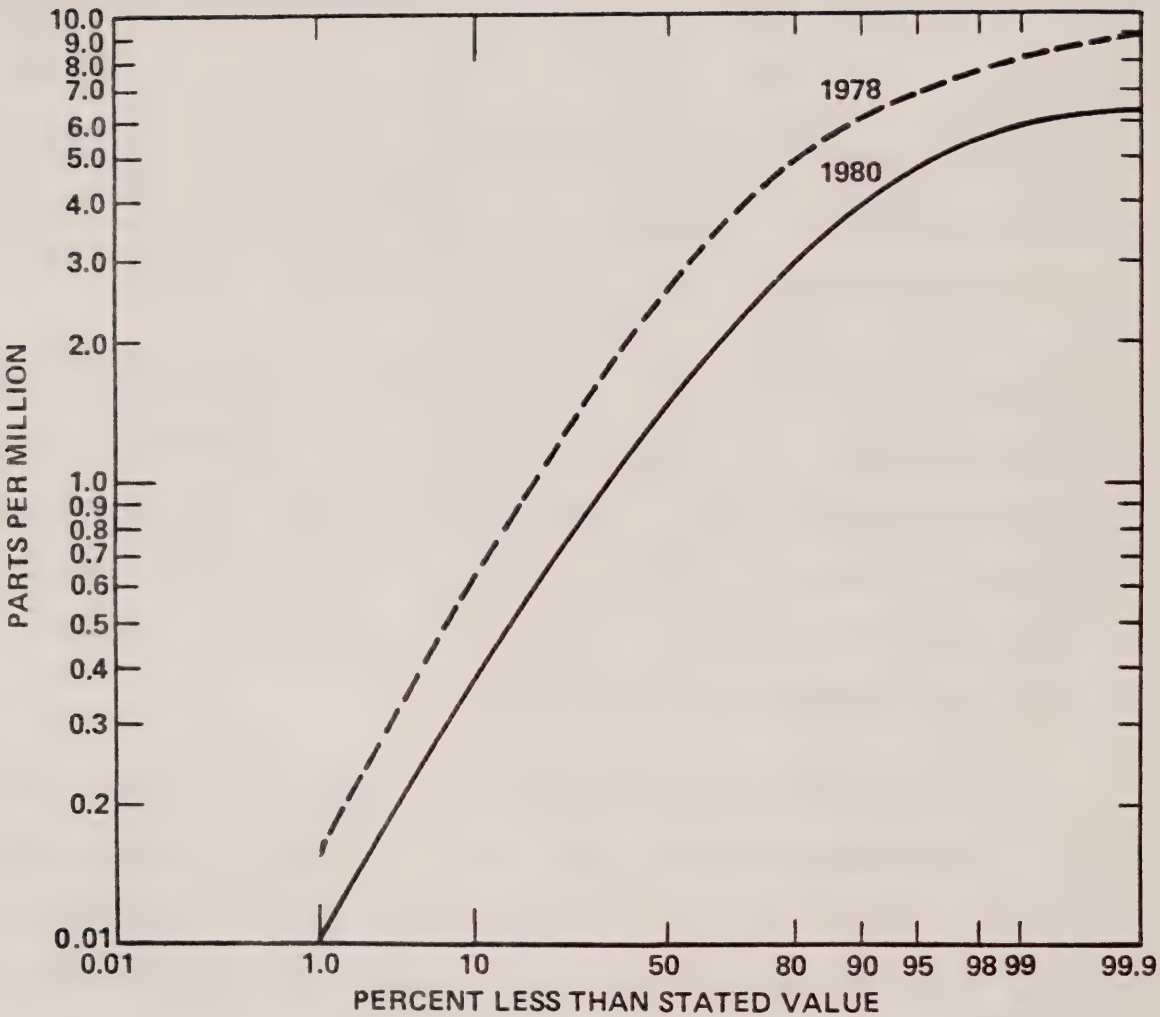


FIG. 5.5.3. FREQUENCY DISTRIBUTION OF HOURLY CO CONCENTRATIONS AT ARCH ST. (1978 AND 1980).

measured 1-hr and 8-hr CO concentrations appear to be significantly greater than the anticipated reduction that might be attributed to the mandatory federal program for exhaust emissions control.

Winter St. The maximum 1-hr CO measured in 1980 is 12 ppm, which is only about 46% of the maximum 1-hr reported for this site in 1978. In 1978, the measured 8-hr CO is 15.2 ppm, and there were seven occasions in which the 8-hr standard was exceeded. In 1980, on the other hand, the maximum 8-hr CO measured was 5 ppm, and no exceedance of the standard was noted. The dramatic improvement at Winter St. reflects the change from a heavily automobile-congested street in 1978 to an auto-free pedestrian mall in 1980.

The dramatic improvement in the ambient CO environment at Winter St. is again evident from the frequency distributions shown in Fig. 5.5.4. The 98 percentile in 1980 is about 5 ppm, which is well below the corresponding percentile of 22 ppm observed in 1978. Equally significant differences are observed for all other percentiles.

Oxides of Nitrogen

Both nitric oxide (NO) and nitrogen dioxide (NO_2) were monitored separately but concurrently at one site on Arch St.

For NO, the maximum 1-hr concentration measured in 1980 is 0.15 ppm, which represents an increase of 8% over the corresponding 1978 level. There is presently no ambient NO standard with which to compare this level.

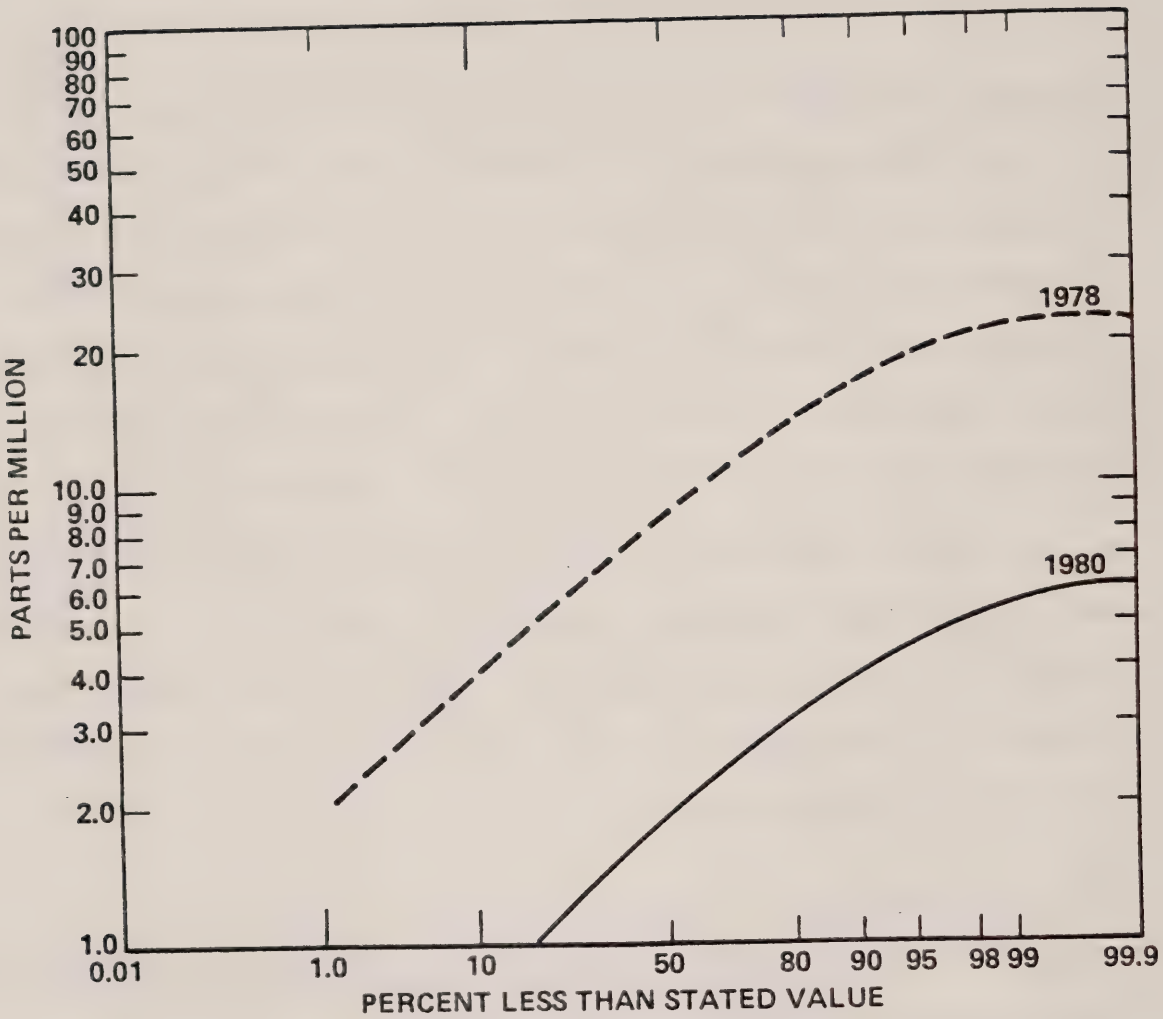


FIG. 5.5.4. FREQUENCY DISTRIBUTION OF HOURLY CO CONCENTRATIONS AT WINTER ST. (1978 AND 1980).

When the 1-hr NO results were plotted as frequency distributions, the 1980 levels were everywhere lower than the corresponding 1978 levels. This was a surprising finding in view of the fact that because of the re-routing of the buses, which are generally high emitters of NO, an overall increase in ambient NO would be more likely. Part of this unexpected trend may be attributed to some observed differences in the meteorology that was encountered during these monitoring periods. In 1978, about 25% of the observed average hourly wind speeds were less than 4 miles per hr (mph), while 75% were in the range of 4 to 12.9 mph. In 1980, only 8% of the average hourly wind speeds were less than 4 mph, and over 10% of the speeds were in excess of 13 mph. Therefore, on an average, the period in 1980 was "windier." An attempt was made to "remove" this wind effect between the 1978 and 1980 results by normalizing the NO results to an assumed 1-mph base and then plotting the resulting hourly NO concentrations as frequency distributions as before. The results are shown in Fig. 5.5.5. As seen in this figure, the 1980 levels are higher than the corresponding levels in 1978 for the higher percentile end. The higher percentile levels are influenced more by event-oriented episodes — such as passing buses or congestion. Therefore, it is not surprising to see that the high percentiles for 1980 are generally higher than the baseline conditions. The frequency distributions exhibit a crossover such that at the low percentile end, it is the 1978 results that are higher than the 1980 counterparts. The low percentile levels are more indicative of overall background levels. Some improvement in the background NO is therefore observed at this site.

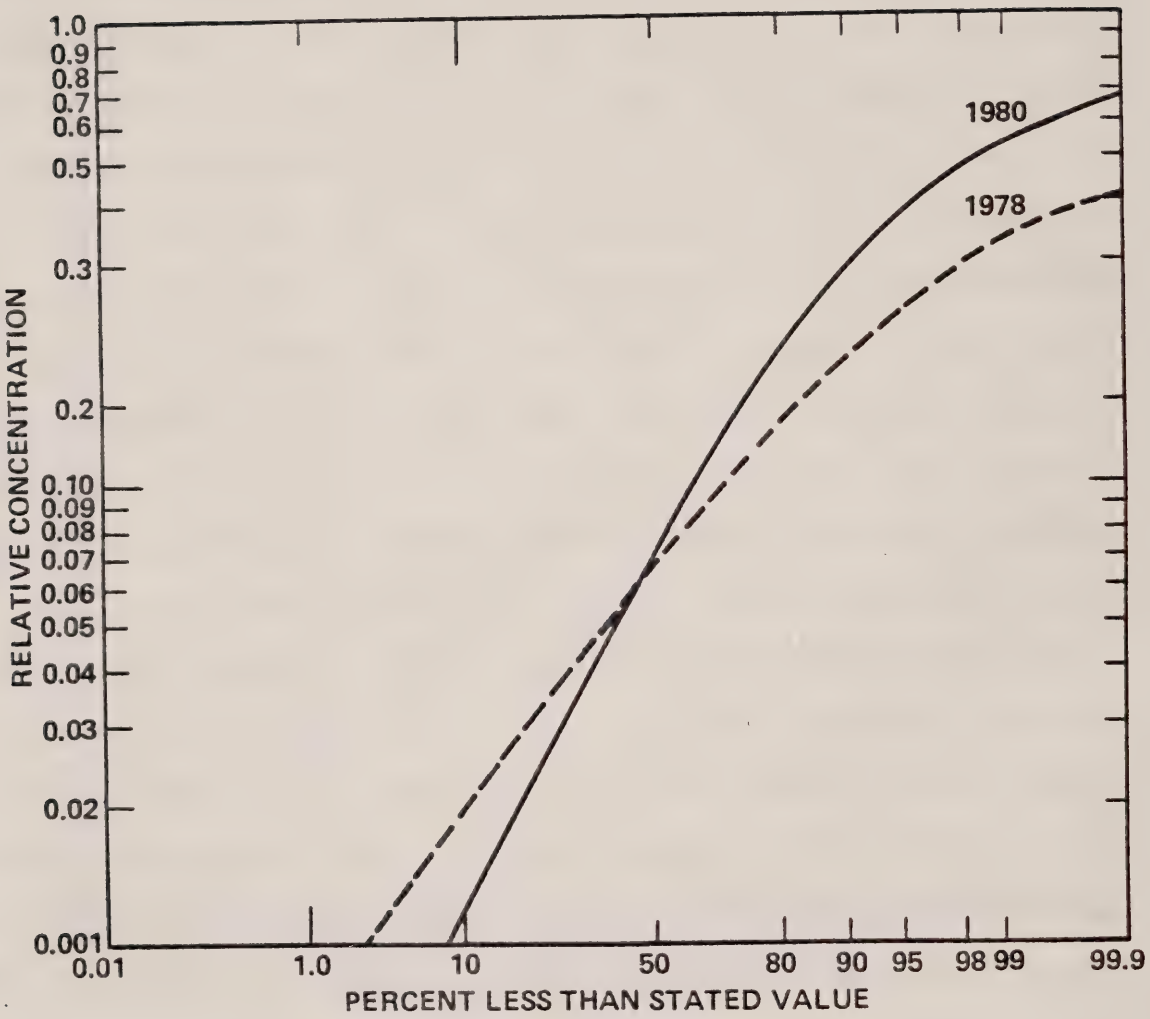


FIG. 5.5.5. FREQUENCY DISTRIBUTION OF HOURLY NO CONCENTRATIONS AT ARCH ST., ADJUSTED TO ELIMINATE EFFECTS OF WIND SPEED (1978 AND 1980).

For NO_2, the maximum 1-hr concentration measured in 1980 is 0.065 ppm. This represents a decrease of 19% from the 1978 level. There is no short-term standard for NO_2 at this time, although there is a proposed standard in the range of 0.25 to 0.5 ppm. The measured results for both 1978 and 1980 are both under the proposed standard.

Hourly NO_2 concentrations for both 1978 and 1980 were again normalized to 1 mph to remove the effects of observed differences in wind speed, and the results were plotted as frequency distributions as shown in Fig. 5.5.6. An examination of these distributions indicates that at all percentile levels less than about 60%, the measured NO_2 levels in 1980 were generally lower than the corresponding 1978 levels. At percentile levels greater than 60%, no measurable differences were observed between 1980 and 1978 results.

Noise

Noise was monitored on a continuous basis at three sites in 1978, but the Post Office site was discontinued in 1980 due to major construction in the immediate vicinity of this site. Consequently, the impact is assessed only at the Arch St. and the Winter St. sites.

To compare the measured noise levels between 1978 and 1980, three different descriptors were used. The first is the day-night sound level, abbreviated L_{dn}, which is a 24-hr equivalent sound level that includes a 10-dB penalty for nighttime (10 p.m. to 7 a.m.) noise. The second descriptor

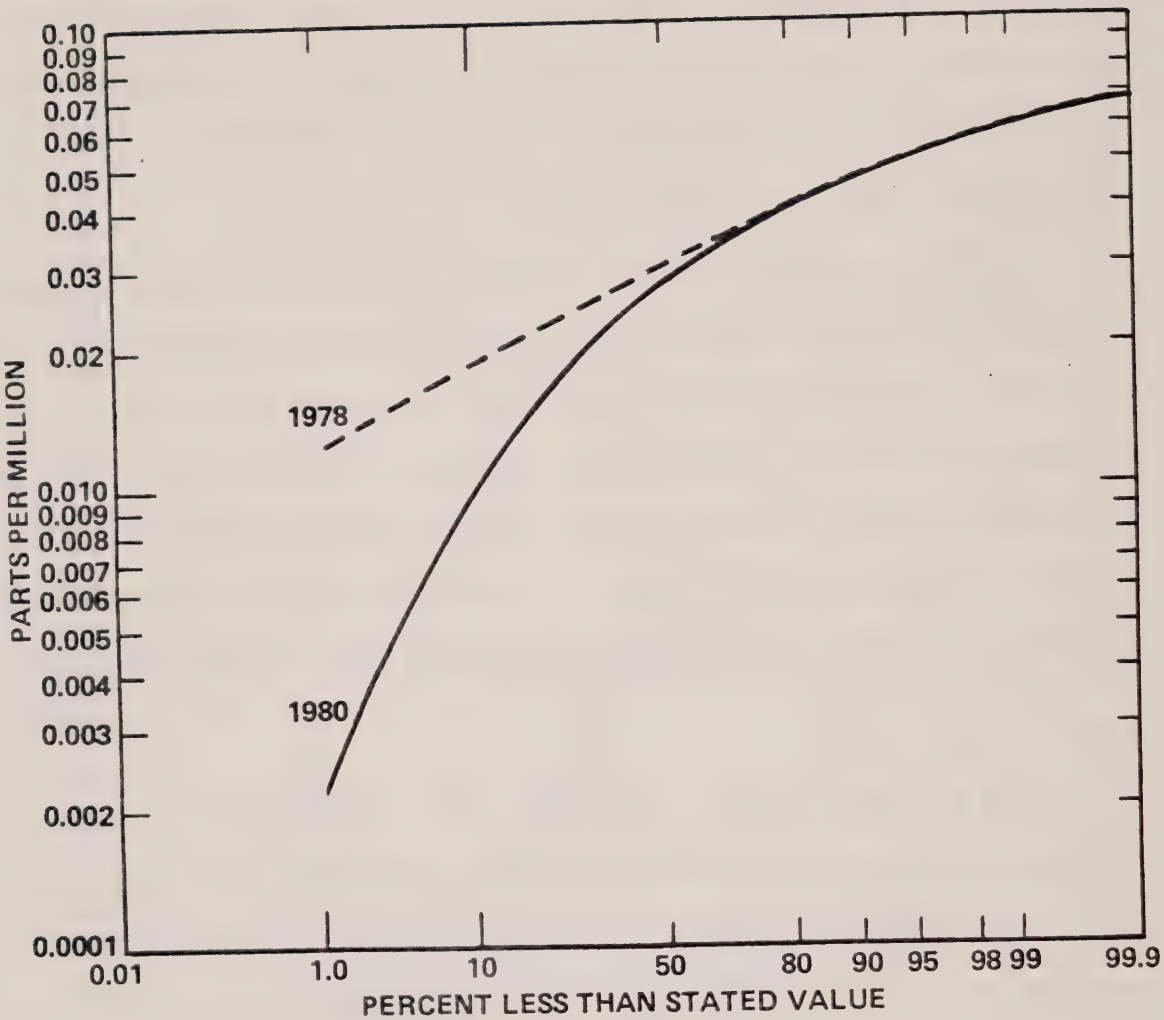


FIG. 5.5.6. FREQUENCY DISTRIBUTION OF HOURLY NO_2 CONCENTRATIONS AT ARCH ST. (1978 AND 1980).

that is used is the hourly L_{eq}, which is a measure of the average noise energy over the period of 1 hr. The third descriptor used for making comparisons was the average weekday L_{dn} and the average weekend L_{dn}. These are logarithmic averages of all weekdays and all weekend days, respectively.

Arch St. In 1978, the maximum L_{dn} measured was 75 dB; in 1980, it was 72 dB. An L_{dn} of 75 dB is not considered an exceptionally high level in this environment. Typical L_{dn}'s found in most major metropolis downtown areas are in the range of 75 to 80 dB. The maximum hourly L_{eq} observed in 1978 was 81 dB(A). In 1980, it was 74 dB(A). The maximum L_{eq}, maximum L_{dn}, and the average weekday and weekend L_{dn} for 1978 and 1980 are presented in Table 5.5.3. When making these comparisons, one should remember that a change of 3 dB is just detectable by the human ear; a change of 5 dB is considered a significant change; and a 10-dB decrease would sound half as loud as the original level. Using the 66-dB normal-voice speech interference criterion, the percent of daytime hourly L_{eq} that exceeded this level in 1978 was estimated at 47%. By 1980, the percent of hourly L_{eq} exceeding 66 dB was estimated to have increased to 54%. Where the hourly L_{eq} is compared with the 72-dB criterion for raised-voice, however, a reverse trend was found. In 1978, about 7% of the daytime hourly L_{eq} was estimated to exceed 72 dB. The percentage of hourly L_{eq} exceeding this criterion was reduced to 3% by 1980. The reduction in the maximum 1-hr L_{eq} and the percent of hourly L_{eq} exceeding 72 dB suggest that there is a small reduction in the high-level noise events. However, this improvement is offset somewhat by an increase in the number of hourly L_{eq} in the range of 66 to 72 dB.

TABLE 5.5.3. CHANGES IN AMBIENT NOISE LEVELS FOR PRE- AND POSTCONSTRUCTION PERIODS.

	Max. 1-hr L_{eq} (dB)	Max. L_{dn} (dB)	% of Daytime 1-hr L_{eq}		Average Weekday L_{dn}(dB)	Average Weekend L_{dn}(dB)
			>66 dB	>72 dB		
Arch St.						
1978	81	74	47	7	72	69
1980	74	72	54	3	71	67
Winter St.						
1978	83	79	89	17	76	74
1980	76	75	59	2	73	70

The L_{dn} in 1980 is seen to have decreased by 2 dB(A) in spite of the increased presence of buses, which are generally more "noisy" than automobiles. Because most of the buses are operated during the nonpenalty hours (between 7 a.m. and 10 p.m.), their impact on L_{dn} is minimal. The average weekday L_{dn} dropped 1 dB from 72 dB in 1978 to 71 dB in 1980. The average weekend L_{dn} dropped 2 dB from 69 dB in 1978 to 67 dB in 1980. A decrease of 2 dB is not considered a significant change.

Winter St. Table 5.5.3 also shows the maximum L_{dn}, the maximum hourly L_{eq}, and average weekday and weekend L_{dn} at Winter St. An examination of the tabulated results in 1978 and 1980 suggests that the noise levels have significantly improved with the Project implementation. For example, the maximum L_{dn} in 1980 is 75 dB, which is 4 dB lower than the corresponding 1978 result. Maximum hourly L_{eq} in 1980 is also lower (by 7 dB) when compared with the preconstruction level. The percent of daytime hourly L_{eq} that exceeds the 66-dB criterion for normal voice speech interference shows a significant reduction from the 1978 value of 89% to 59% following project implementation. Similarly, using a raised-voice criterion of 72 dB, the percent of time that the hourly L_{eq} exceeded this level is reduced from 17% to 2%. Average weekday L_{dn} dropped from 76 dB in 1978 to 73 dB in 1980, and average weekend L_{dn} dropped 4 dB from 74 dB in 1978 to 70 dB in 1980. This change would be detectable to the human ear.

The above noise analysis has only assessed the impact from the standpoint of changes in noise levels. There is another aspect of the noise

environment that cannot be quantified and that is especially applicable to the Winter St. site. The character of the noise has changed. In 1978, the noise sources were predominantly cars, buses, and trucks. In 1980, the sources are human voice, hawkers, trucks (in the a.m. only), and music. To enhance the enjoyment of the pedestrian mall, concerts by small bands of musicians were frequently observed during the 1980 monitoring period. The sound from the musical instruments will contribute to the measured noise levels (i.e., increasing the L_{eq} and the L_{dn}). However, these two descriptors, which are used to compare the pre- and postconstruction impact, cannot, by themselves, differentiate between sounds from the musical instruments and noise from automobile traffic if their overall levels are the same.

APPENDIX A. FIELD MONITORING PROGRAM

A.1 Objective and Scope

The objective of this study was to measure the changes in the ambient levels of carbon monoxide (CO), oxides of nitrogen (NO_x), and noise associated with the changes in motor vehicle traffic due to construction of the Downtown Crossing Project. The monitoring period covered approximately two weeks in July 1978, before construction, and two weeks in July 1980, after construction.

A.2 Site Selection

A total of four measurement sites were selected for monitoring in 1978. The selection of these sites was based on a number of considerations, including:

1. Severity of existing traffic congestion problem
2. Anticipated changes with the implementation of the Downtown Crossing Project
3. Proposed bus routing
4. Availability and accessibility of the site.

The sites chosen in 1978 were the Post Office cafeteria, the Post Office roof, Arch St., and Winter St. In 1980, the Post Office cafeteria site was eliminated due to the fact that construction activity was going on around the site, and it was expected to continue through the monitoring period. The construction activity would have affected the noise and CO measurements at that site and would have invalidated any comparison to the 1978 data. The monitoring sites in 1980

included the Post Office roof, Arch St., and Winter St. The locations of the monitoring sites are depicted in Fig. 5.5.1. The site description, the parameters measured, and the instruments deployed are shown in Table 5.5.1. It should be noted that in 1980 we did not have access to the same building on Winter St. that was used in 1978. A building about 100 ft away, approaching Washington St., was used instead. This site was sufficiently close to the 1978 site such that data measured at this site should continue to be indicative of conditions at Winter St.

Probe location for air sampling followed established EPA guidelines. Summary descriptions of probe location and sensor placement for each site are given below.

A.2.1 Post Office cafeteria site

Air samples were drawn in by a manifold system at approximately 15 ft from street level and 3 ft from the wall. Individual air intakes from manifold to the NDIR and the ecolyzer were achieved by 3- to 6-ft tygon tubing. The microphone for the noise monitor was mounted on a boom extending 6 ft from the window. The electronic wind sensor was mounted on a separate boom and extended approximately 7 ft from the wall and was relatively free from wind effects and from nearby objects.

A.2.2 Post Office roof site

The wind sensor was mounted on top of a boom extending about 10 ft from the highest part of the Post Office roof. Influence from antenna structures on the roof was judged to be insignificant. With the possible exception of the Shawmut Bank Building, this site was relatively free from wind effects of nearby structures.

A.2.3 Arch St. site

Air samples for CO were taken at approximately 12 ft above the sidewalk and 2 ft from the wall. For NO/NO_2, a separate intake was used. Air was drawn at about 25 ft above sidewalk (corresponding to the level of the window on the first floor) and about 8 ft from the wall. All pneumatic plumbing was made of inert teflon. The microphone was mounted on a boom extending about 8 ft out of the window. The wind sensor was mounted on its own boom and extended about 8 ft from the wall. The wind sensor was approximately 15 ft from a nearby 5-ft protruding wall face.

A.2.4 Winter St. site

Air samples for CO were taken at approximately 12 ft from the sidewalk and 3 ft from the wall. The microphone for the noise monitor was mounted on a boom at this height but extending about 5 ft from the wall.

A.3 Measurement Methods

A.3.1 Carbon monoxide

CO concentrations were measured by two different types of equipment. The first is a Beckman nondispersive infrared (NDIR) analyzer (Model 865 with the autospan option). The other is an Energetics Science Ecolyzer, which works on an electrochemical principle. The NDIR method is an EPA-referenced method for measuring CO. All CO monitors were used in conjunction with strip chart recorders that depicted concentration data on a continuous basis.

A.3.2 Oxides of nitrogen

Both NO and NO_2 were measured using a Monitor Labs chemiluminescent analyzer (Model 8440E). Both oxide species were recorded continuously and concurrently.

A.3.3 Noise

Noise levels were measured using BBN's Model 614 portable noise monitors. Average hourly noise levels along with 24-hr noise statistics were recorded automatically.

A.3.4 Wind

Wind speed and wind direction were measured using a Climatronics Electronic Weather Station, a Texas Instrument Electronic Wind Sensor, and a MRI Mechanical Weather Station. Both wind speed and direction were recorded continuously and concurrently on a strip chart recorder.

A.4 Quality Assurance Procedures

A.4.1 Carbon monoxide

The Beckman 865 NDIR analyzer was serviced and checked at BBN's laboratory before installation at the Post Office cafeteria site in 1978. The Beckman analyzer was programmed for automatic zero and span calibration checks every 6 hr. A 45-ppm span gas from Matheson was used for span checks. Because the Post Office cafeteria site was eliminated in 1980, the NDIR was not used in 1980. Ecolyzers were calibrated manually twice a day, using a 45-ppm span gas. All CO data were recorded continuously on strip chart recorders. The data

were screened and then labeled and digitized electronically to produce hourly average CO concentrations.

A.4.2 Nitrogen oxides

Calibration of the NO_x analyzer was accomplished through the use of the Monitor Lab Model 8500 PERMACAL dynamic calibration system. Calibration was performed after installation at the site, about one week into the measurement program, and just prior to the end of the program. The calibration used standard NO gas (traceable to NBS standard), which was subsequently diluted to the desired concentration during the actual calibration, and a NO_2 permeation tube. Both NO and NO_2 data were recorded simultaneously on a dual-channel chart recorder. These data were digitized to produce hourly values of NO and NO_2 separately.

A.4.3 Noise

The BBN Model 614 noise monitors were calibrated daily using such acoustic calibrators as B&K 4220 and GR 1567. Hourly noise levels and 24-hr noise statistics (e.g., L_{dn}) were printed automatically on a paper tape.

A.4.4 Wind

Wind speed sensors were calibrated in the laboratory, and no additional calibration in the field was required. Wind direction calibration was performed during installation at the site using existing landmarks. Both wind speed and wind direction data were recorded continuously on strip charts. These data were digitized to produce hourly average results.

APPENDIX B. FIELD MEASUREMENT RESULTS

B.1 Carbon Monoxide

B.1.1 Post office site

The nondispersive infrared (NDIR) CO analyzer deployed at this site collected data on a continuous basis from 10 July 1978 through 26 July 1978. Data capture was estimated at 96%. Highest 1-hr average was 20 parts per million (ppm), which took place at 10 a.m. on a Tuesday. Low 1-hr average readings of between 1 ppm and 2 ppm occurred quite frequently between 1 a.m. to 5 a.m. No violation of the 1-hr standard of 35 ppm was observed. The highest 8-hr average was 12 ppm, recorded on a Tuesday at 5 p.m. During this monitoring period, there were 3 occasions (of nonoverlapping 8-hr time periods) for which the 8-hr standard of 9 ppm was exceeded.

Figure B.1 shows the variation of the ambient CO levels at this site for selected days of the week. On weekdays, CO levels rose rapidly from about 7 a.m. Maximum CO levels occurred around the evening rush hour at 5 p.m. Levels on Saturdays were generally low, the evening rush hour peak was absent, and the levels remained between 4 and 9 ppm late into the night. Table B.1 describes both the 1-hr and 8-hr standard for CO and the number of exceedances at the Post Office site.

The CO ecolyzer that was placed next to the NDIR was operated from 10 July 1978 through 25 July 1978. Data capture rate was low — about 65%. This was due primarily to equipment instability during unattended operation at night and on weekends. During periods of attended calibration, the CO readings on the ecolyzer corresponded fairly well with the NDIR readings.

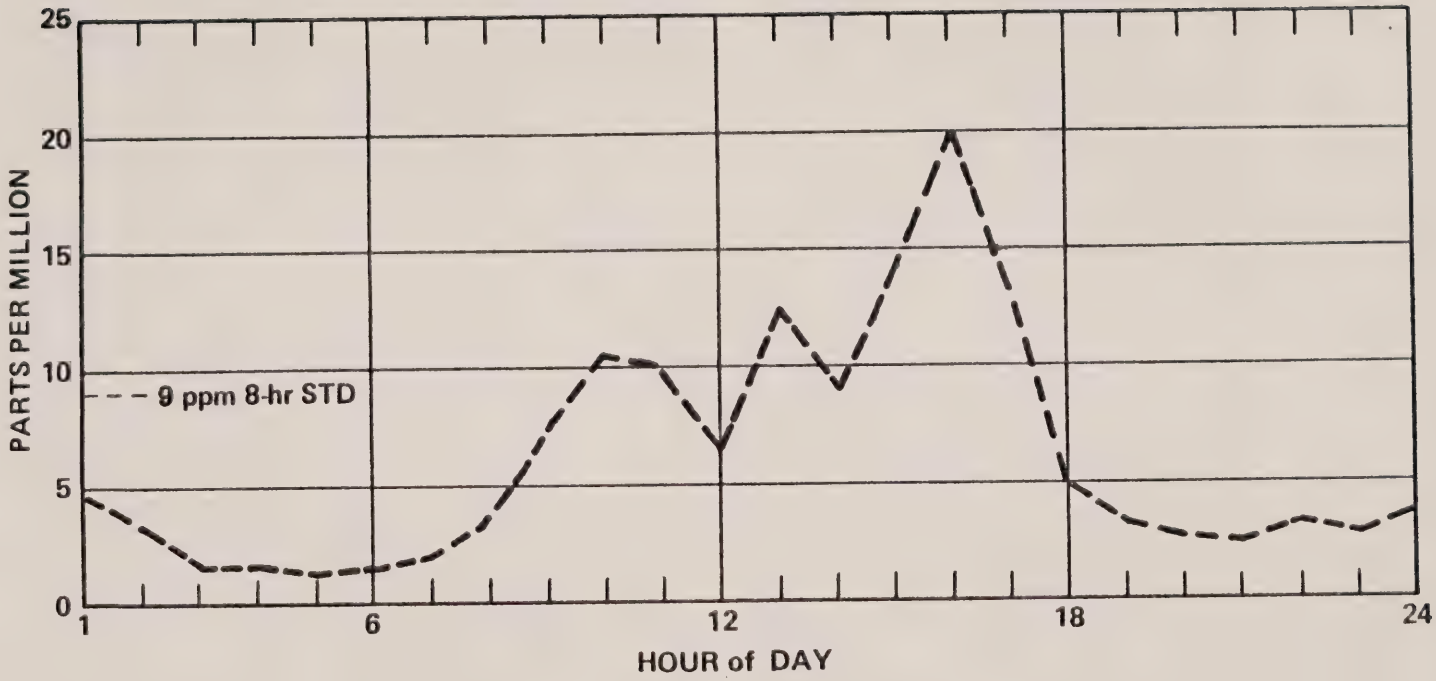


FIG. B.1(a). MEASURED HOURLY AVERAGE CARBON MONOXIDE (CO) LEVELS AT THE POST OFFICE SITE ON TUESDAY, 7/18/78.

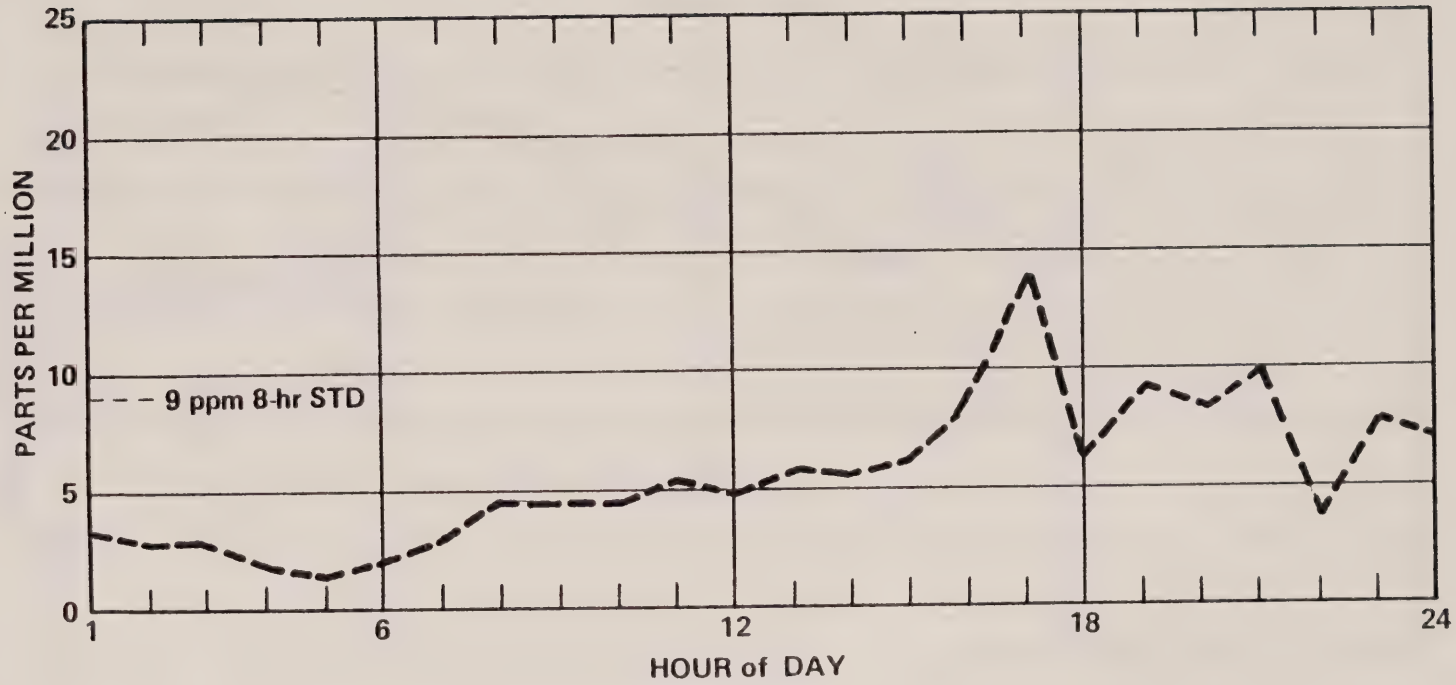


FIG. B.1(b). MEASURED HOURLY AVERAGE CARBON MONOXIDE (CO) LEVELS AT THE POST OFFICE SITE ON WEDNESDAY, 7/12/78.

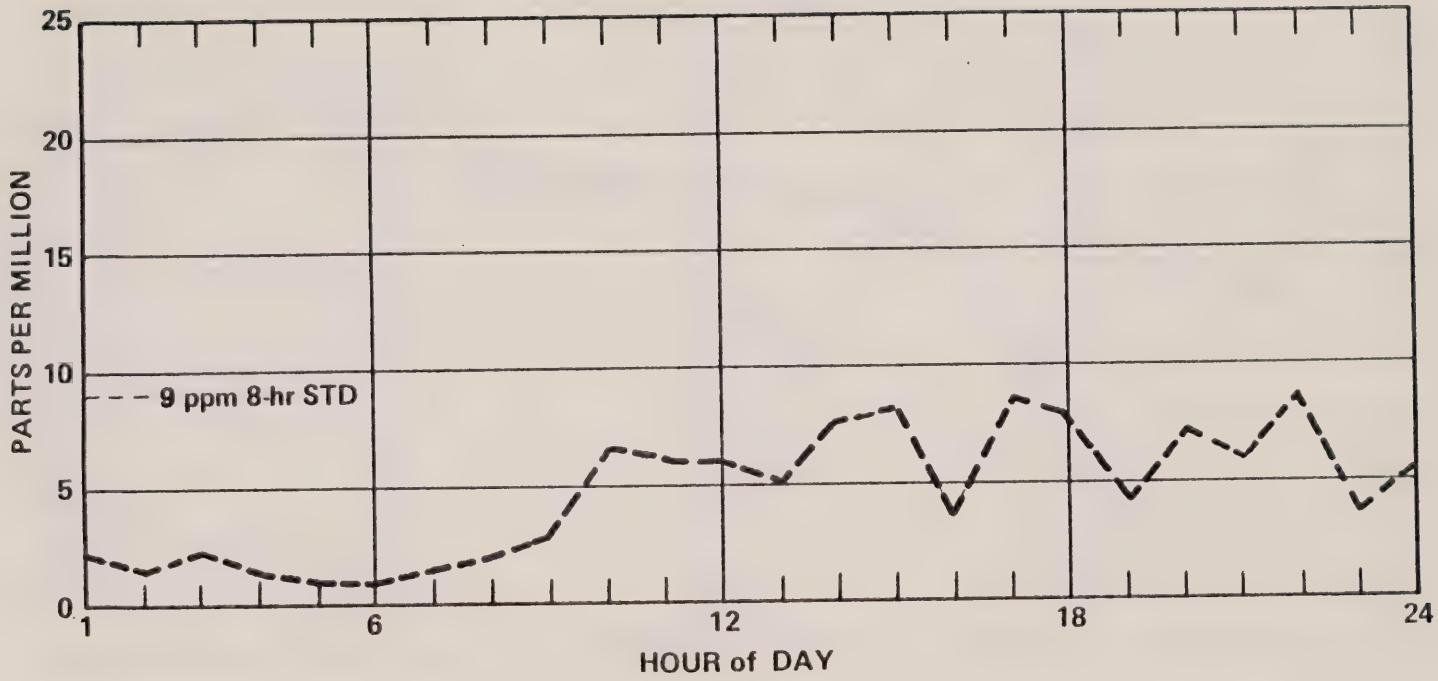


FIG. B.1(c). MEASURED HOURLY AVERAGE CARBON MONOXIDE (CO) LEVELS AT THE POST OFFICE SITE ON SATURDAY, 7/15/78.

TABLE B.1. MEASURED CO IN THE PROJECT AREA.

Site Description	Year	Max. 1-hr ppm	No. of Times > Std. (35 ppm)	Max. 8-hr ppm	No. of Times > Std. (9 ppm)
Post Office Building	1978	20.2	0	11.6	3
	1980	—*	—	—	—
Arch St.	1978	15.7	0	7.4	0
	1980	6.4	0	4.4	0
Winter St.	1978	26.3	0	15.2	7
	1980	12.0	0	5.0	0

*In 1980, the Post Office site was discontinued.

Due to major construction projects in the immediate vicinity of the Post Office, no data were collected at this site in 1980. The construction has resulted in disrupted traffic patterns and flows, and the construction equipment on the site itself has considerably increased noise levels. Impacts from Downtown Crossing project, therefore, could not be determined at this site.

B.1.2 Arch St. site

In 1978, a CO ecolyzer was operated from 9 July through 26 July. Data capture during this period was estimated at 65%. Highest 1-hr average CO reading was 16 ppm, which took place at 6 p.m. on a Monday. Low 1-hr readings of 2 ppm or less were frequently encountered between midnight and 7 a.m.

In 1980, a CO ecolyzer was operated from 7 July to 24 July. Data capture during this period was estimated at 100%. Highest 1-hr average CO reading was 6.4 ppm, which took place at 10 p.m. on a Monday. Low 1-hr readings of 2 ppm or less were frequently encountered between midnight and 7 a.m.

Figure B.2 shows the diurnal variation of CO levels at this site for a Monday and a Thursday. The CO buildup in the morning was slow compared to readings taken at the Post Office site. Maximum levels were observed at 6 p.m. In neither year was there an exceedance of the 1-hr standard. The highest 8-hr average in 1978 was about 7.0 ppm, which occurred on a Monday between noon and 7 p.m. There was no violation of the 8-hr standard. The highest 8-hr average for 1980 was about 4.4 ppm, which occurred on a Thursday between 5 a.m. and noon. There was no violation of the 8-hr standard.

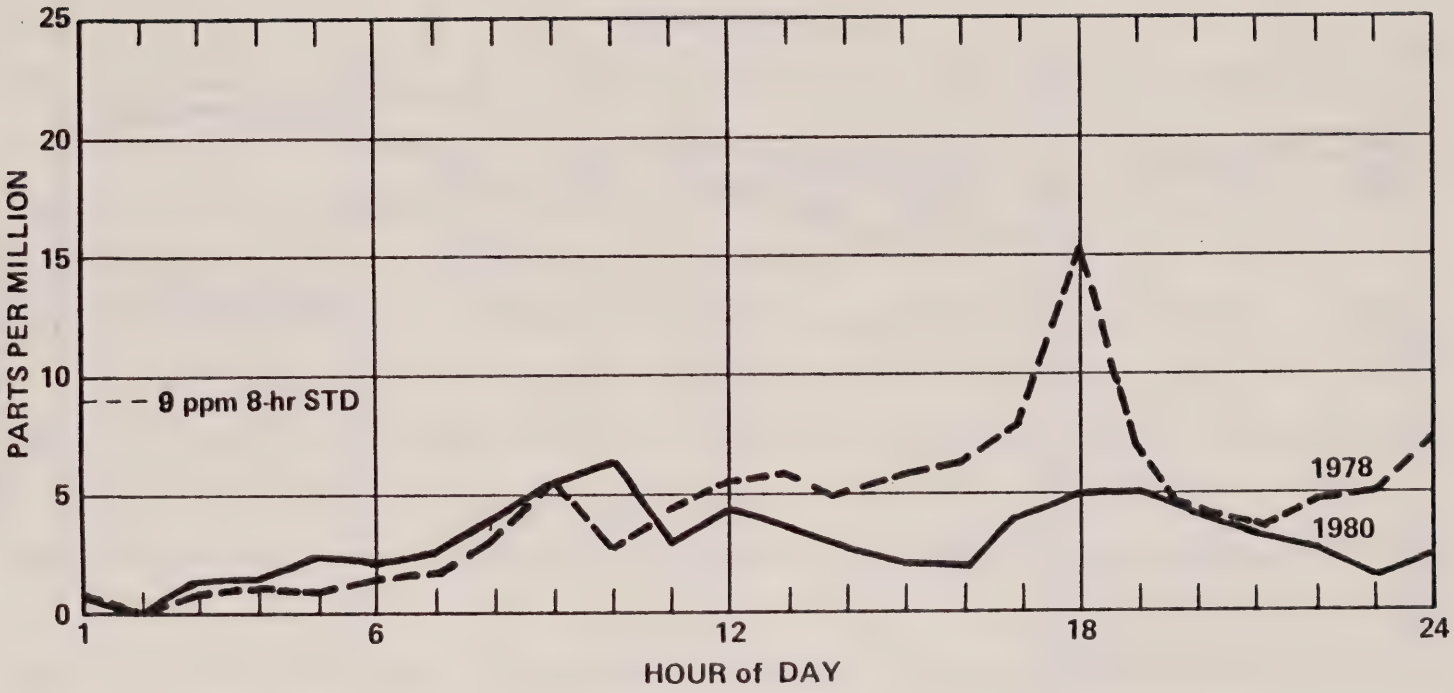


FIG. B.2(a). MEASURED HOURLY AVERAGE CARBON MONOXIDE (CO) LEVELS AT ARCH ST. ON MONDAY, 7/17/78 AND ON MONDAY, 7/21/80.

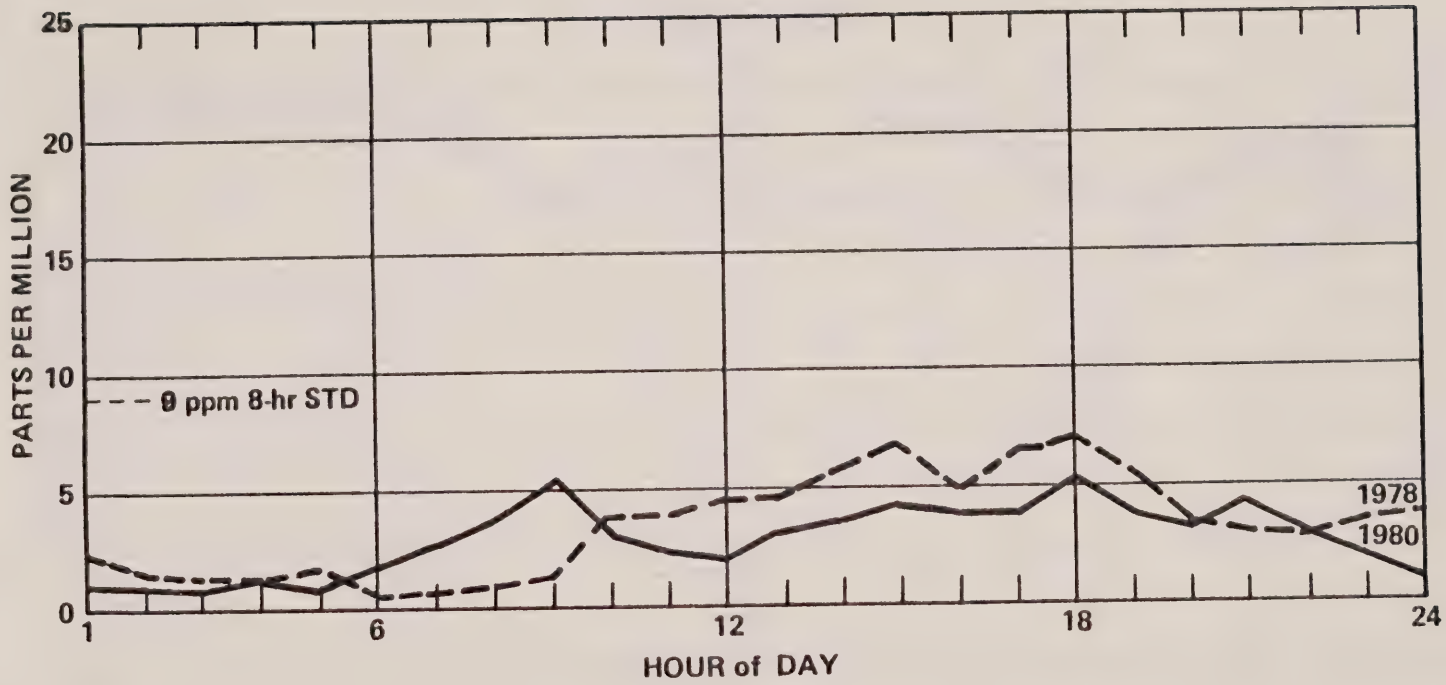


FIG. B.2(b). MEASURED HOURLY AVERAGE CARBON MONOXIDE (CO) LEVELS AT ARCH ST. ON THURSDAY, 7/13/78 AND ON THURSDAY, 7/17/80.

Table B.1 describes the maximum 1-hr and 8-hr average at this site and the number of times the standard was exceeded.

B.1.3 Winter St. site

In 1978, a CO ecolyzer was operated at this site from 12 July through 26 July. Data capture was estimated at 50%. Highest 1-hr average CO reading was 26 ppm, which took place at 6 p.m. on a Monday. During periods of traffic congestion, idling automobiles were backed up past the location of the CO monitor. However, no exceedance of the 1-hr standard was observed. Highest 8-hr average reading was 15 ppm, which occurred between 2 p.m. and 9 p.m. on a Monday. There were seven occasions of violation of the 8-hr standard of 9 ppm during this sampling period.

In 1980, a CO ecolyzer was operated at this site from 7 July through 24 July. Data capture was estimated at 80%. Highest 1-hr average CO reading was 12 ppm, which took place at 11 a.m. on a Tuesday. The highest 8-hr average reading was 5 ppm, which occurred from 1 a.m. to 8 a.m. on a Wednesday. There was no exceedance of either the 1-hr or 8-hr standard during this sampling period.

Figure B.3 shows the hourly variation of CO levels recorded at this site for 1978 and 1980, for a Monday and a Thursday. In 1978, the levels recorded at Winter St. were generally much higher than those measured at Arch St. or at the Post Office. Maximum levels occurred both during the lunch hour and the evening rush hour. In 1980, levels measured at Winter St. were generally much lower than those at Arch St.

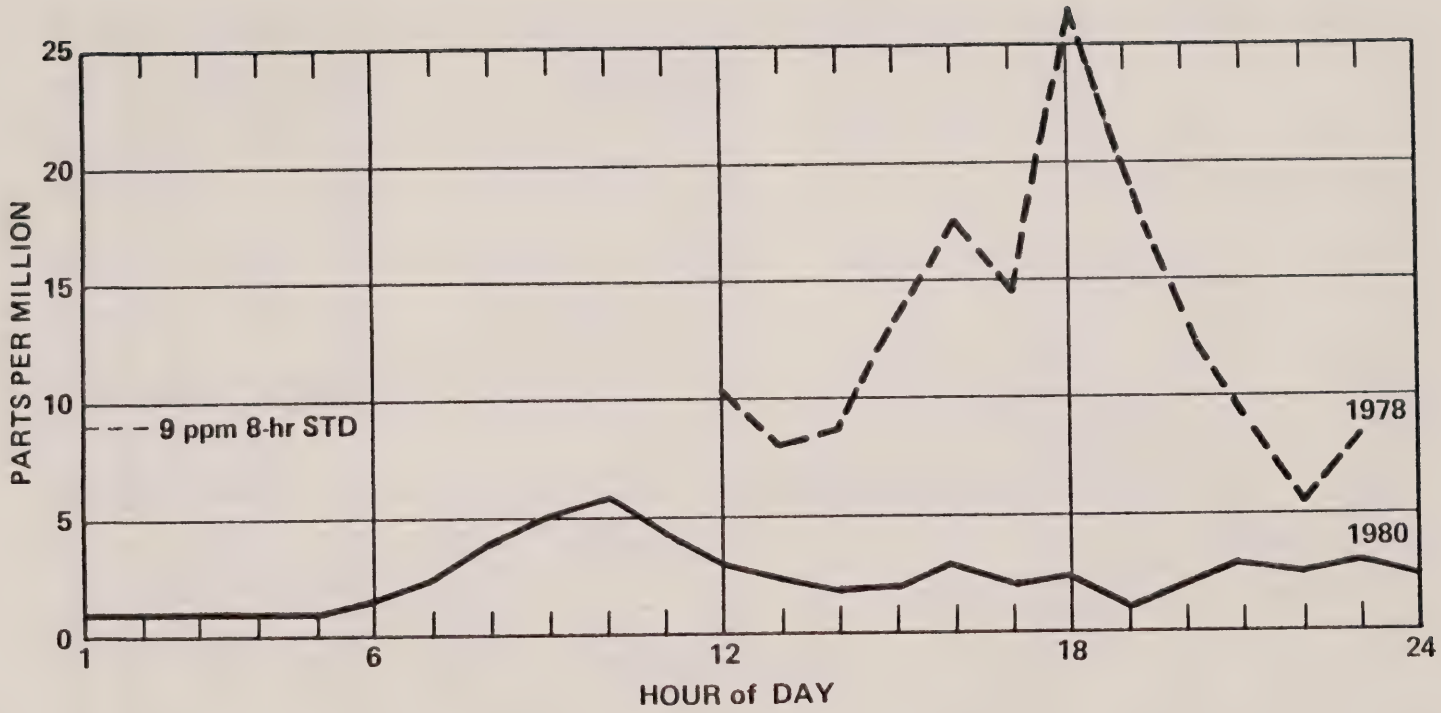


FIG. B.3(a). MEASURED HOURLY AVERAGE CARBON MONOXIDE (CO) LEVELS AT WINTER ST. SITE ON MONDAY, 7/13/78 AND ON MONDAY, 7/21/80.

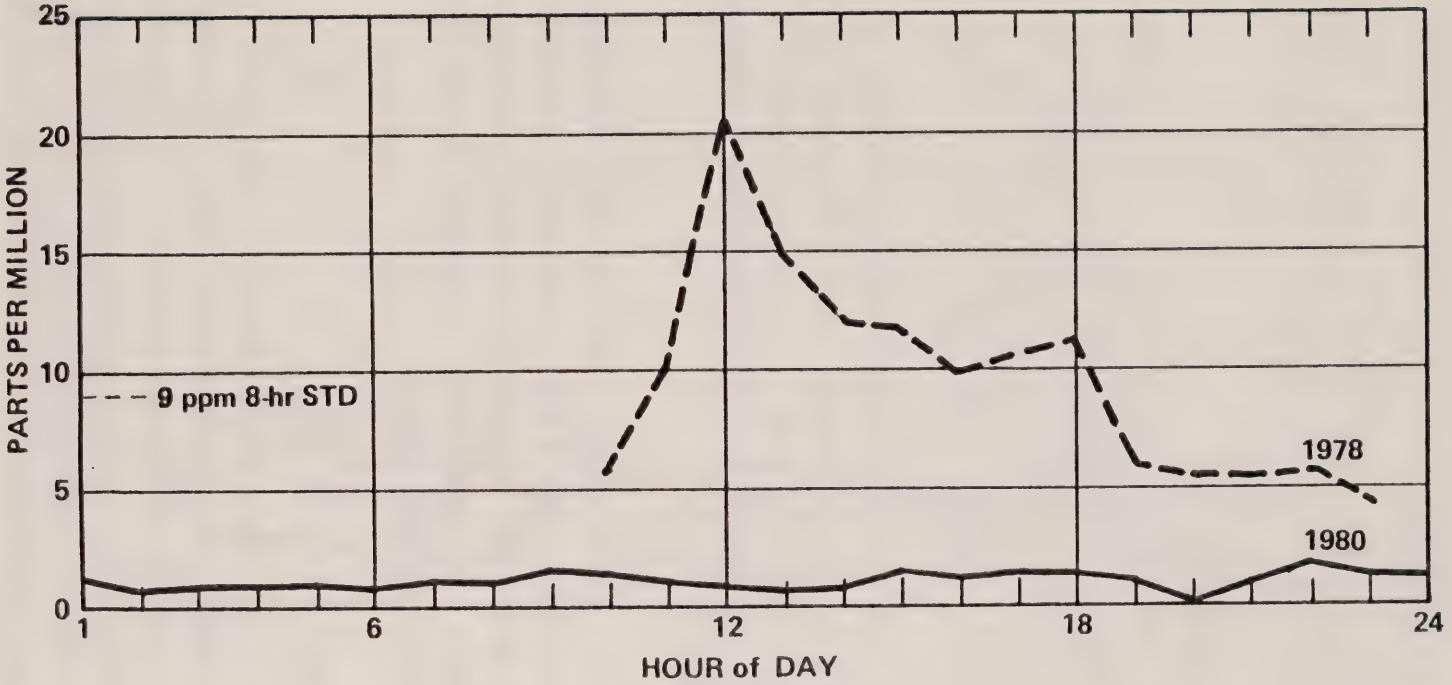


FIG. B.3(b). MEASURED HOURLY AVERAGE CARBON MONOXIDE (CO) LEVELS AT WINTER ST. SITE ON THURSDAY, 7/20/78 AND ON THURSDAY, 7/10/80.

B.2 Oxides of Nitrogen

Both nitric oxide and nitrogen dioxide were measured by chemiluminescent method at the Arch St. site only.

B.2.1 Nitric oxide (NO)

In 1978, NO was monitored from 7 July through 26 July on a continuous basis. Data capture was estimated at 92%. Highest 1-hr average reading of 0.14 ppm was recorded at midnight on a Monday. During the hours from 7 a.m. through 6 p.m., readings ranged from 0.01 ppm to 0.07 ppm.

In 1980, NO was monitored from 7 July to 25 July. Data capture rate was estimated at 90%. Highest 1-hr average reading of 0.15 ppm was recorded at 9 a.m. on a Monday. During the hours from 7 a.m. through 6 p.m., readings ranged from 0.01 ppm to 0.15 ppm.

Figure B.4 shows the variation of observed hourly averaged NO for two weekdays and a Saturday and compares 1978 to 1980 data. There does not appear to be any pronounced diurnal pattern. Table B.2 shows the maximum 1-hr NO level. There is no standard for nitric oxide.

B.2.2 Nitrogen dioxide (NO_2)

In 1978, NO_2 was measured from 7 July through 26 July. Data capture rate was estimated at 93%. Highest 1-hr average reading of 0.08 ppm was recorded at 2 p.m. on a Tuesday. There were no violations of the proposed standard; levels were low, that is, only 49 occasions for which 1-hr averages of 0.05 ppm or greater were recorded. Lowest 1-hr reading recorded was 0.02 ppm. Daily (midnight to midnight) average readings ranged from a low of 0.02 ppm to a high of 0.05 ppm.

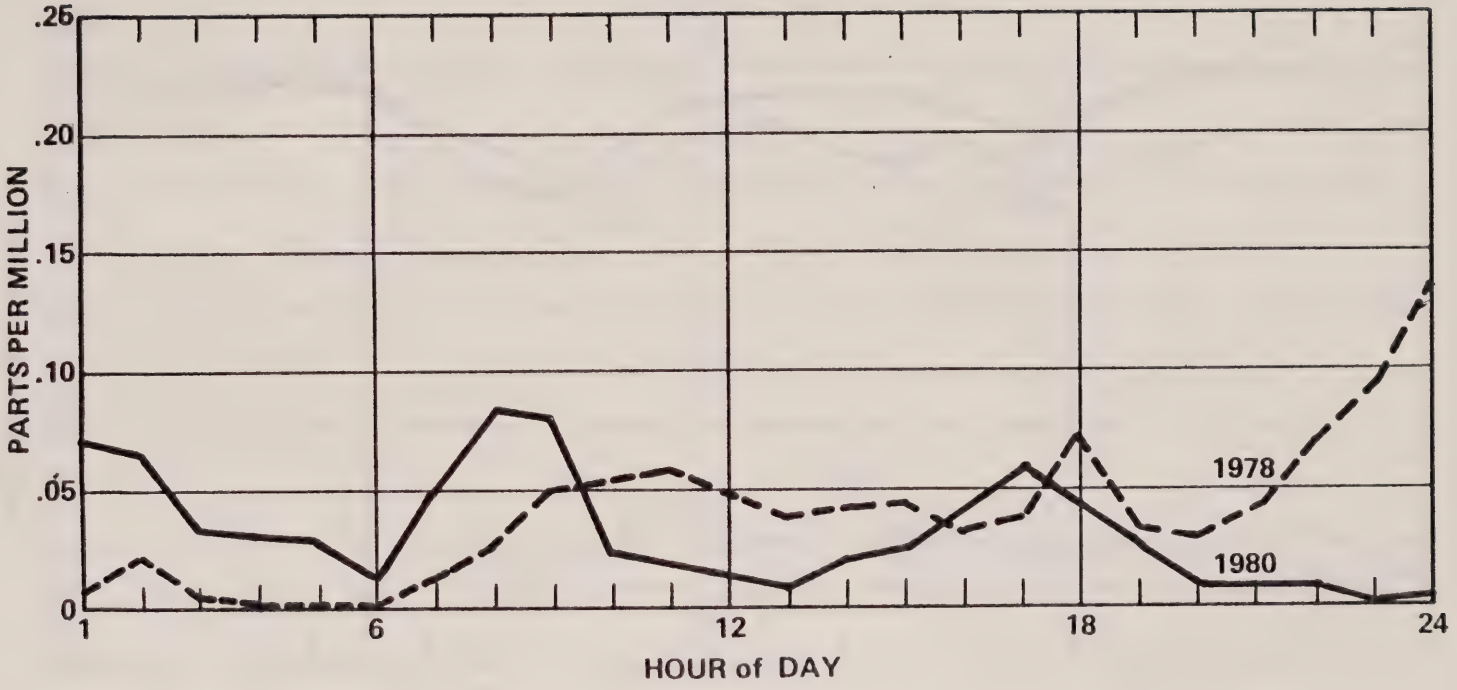


FIG. B.4(a). MEASURED HOURLY AVERAGE NITRIC OXIDE (NO) LEVELS AT ARCH ST. SITE ON MONDAY, 7/17/80 AND ON MONDAY, 7/14/80.

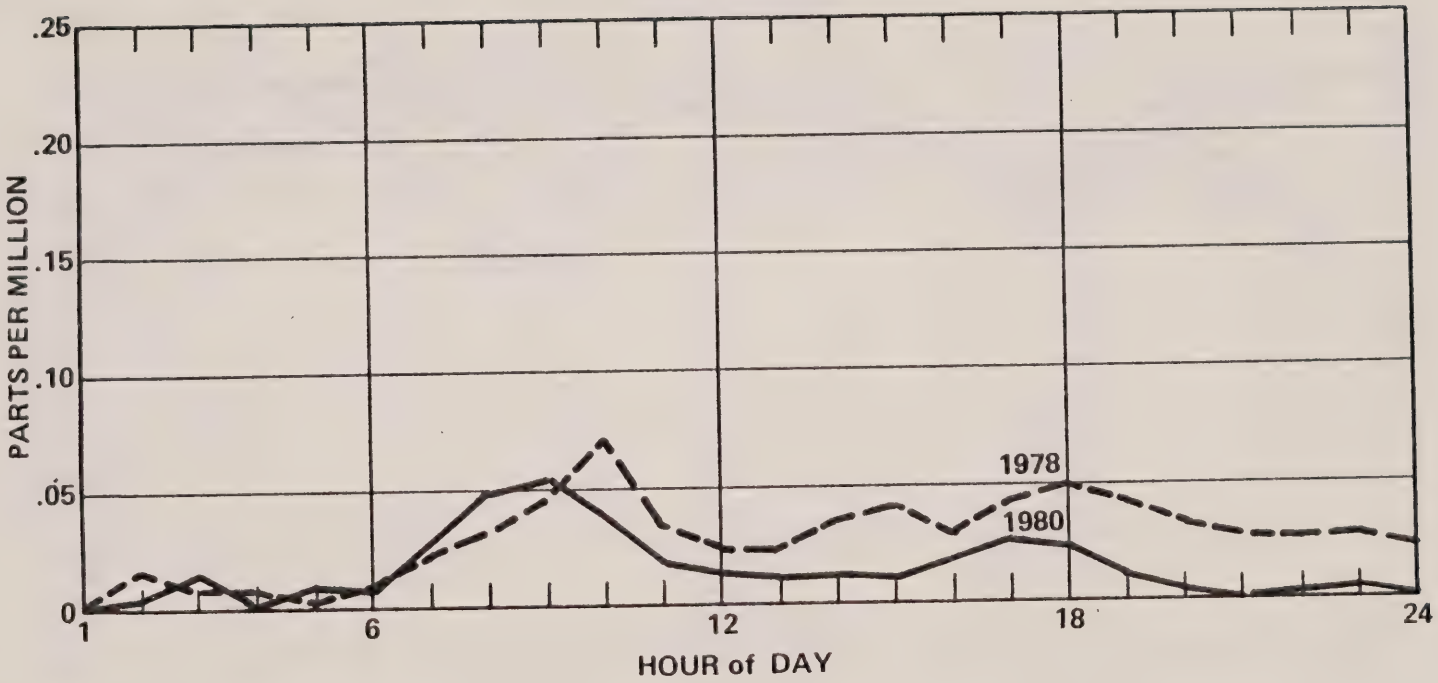


FIG. B.4(b). MEASURED HOURLY AVERAGE NITRIC OXIDE (NO) LEVELS AT ARCH ST. SITE ON TUESDAY, 7/25/78 AND ON TUESDAY, 7/15/80.

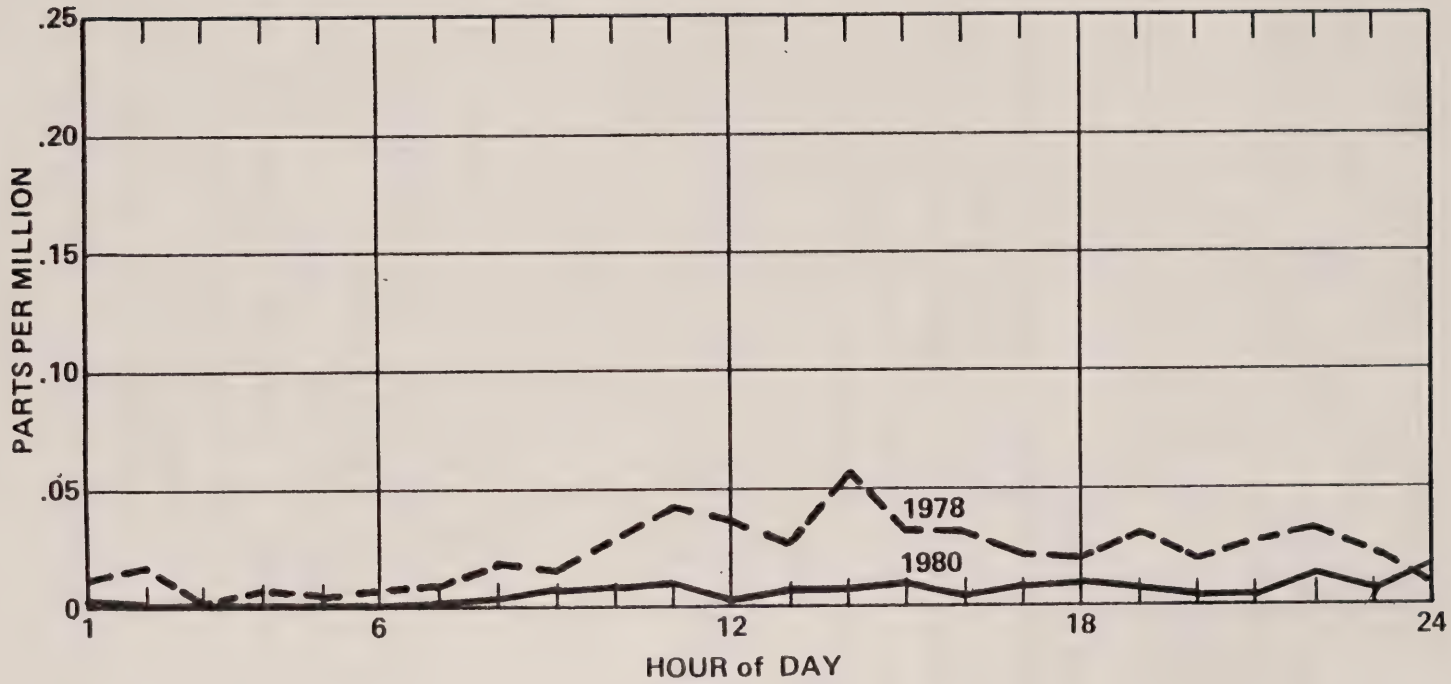


FIG. B.4(c). MEASURED HOURLY AVERAGE NITRIC OXIDE (NO) LEVELS AT ARCH ST. SITE ON SATURDAY, 7/15/78 AND ON SATURDAY, 7/12/80.

TABLE B.2. MEASURED NITROGEN OXIDES AT THE ARCH ST. SITE.

Year	Max. 1-hr NO ppm	No. of Times >Std.*	Max. 1-hr NO_2 ppm	No. of Times >Std.† (0.25-0.5 ppm)
1978	0.14	--	0.080	0
1980	0.151	--	0.065	0

*No standard.

†Proposed standard.

In 1980, NO_2 was measured from 7 July through 25 July. Data capture rate was estimated at 94%. Highest 1-hr average reading of 0.065 was recorded at 5 p.m. on a Tuesday. There was no violation of the proposed NO_2 standard; levels in 1980 were low, that is, only 38 occasions for which 1-hr averages of 0.05 ppm or greater were recorded. Lowest 1-hr readings recorded was 0.01 ppm. Daily (midnight to midnight) average readings ranged from a low of 0.01 ppm to a high of 0.04 ppm.

Figure B.5 shows the diurnal variation of observed hourly averaged NO_2 for selected days of the week and compare 1978 to 1980 data. There does not appear to be any correlation between the observed NO_2 and concurrent NO levels, or between NO_2 levels and observed truck activity. Short-term NO_2 standards have not been promulgated at this time, but a standard of 0.25 ppm to 0.50 ppm has been proposed. Table B.2 shows the maximum hourly NO_2 levels and indicates that there were no exceedances of the proposed NO_2 standard.

B.3 Noise

B.3.1 Post Office site

In 1978, the BBN Model 614 Noise Monitor collected data at this site from 10 July through 26 July. Figure B.6 shows the diurnal variation of the sound level (as measured by the parameter, L_{eq}) for two days of the week, a Thursday and a Saturday. Figure B.6 also indicates that the loudest times of days vary according to the day of the week. During the weekdays, the hourly L_{eq} ranged from 65 to 70 dBA from about 7 a.m. until about 7 p.m. On Saturdays, the sound levels increased more

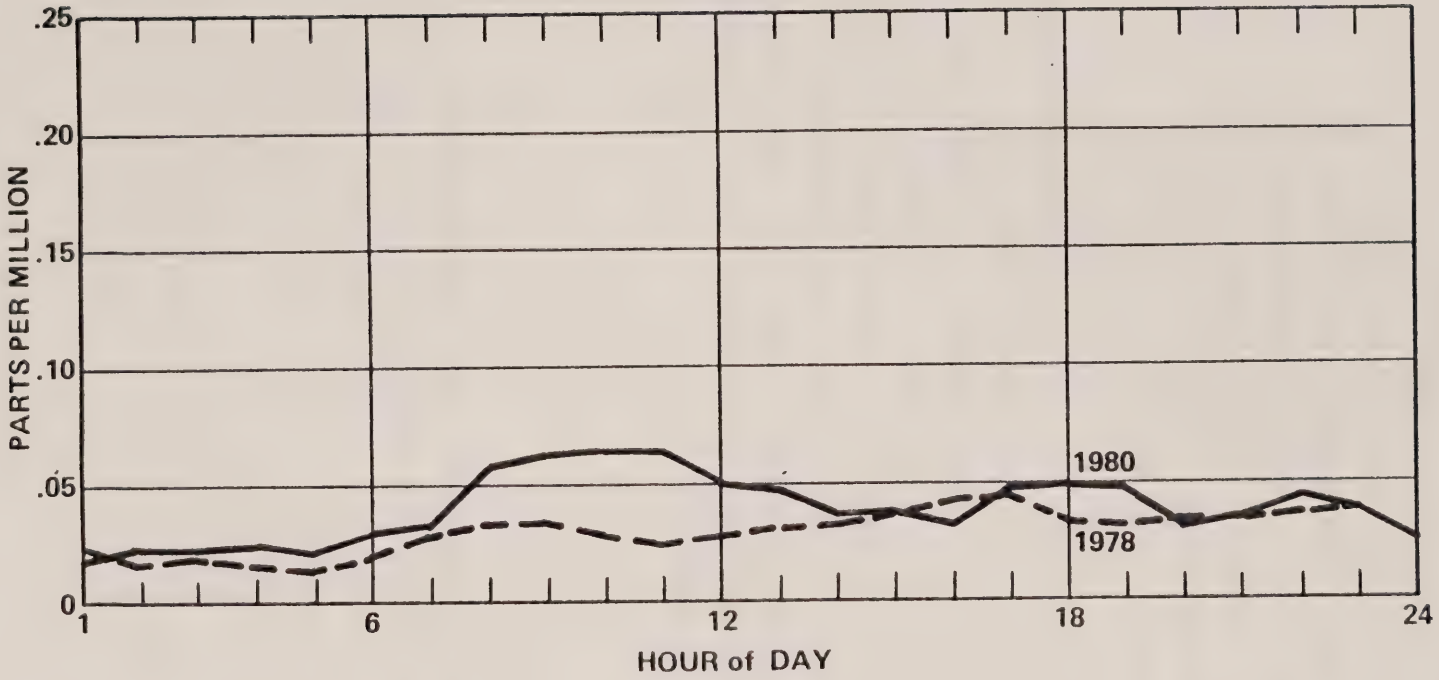


FIG. B.5(a). MEASURED HOURLY AVERAGE NITROGEN DIOXIDE (NO_2) LEVELS AT ARCH ST. SITE ON MONDAY, 7/17/78 AND ON MONDAY, 7/21/80.

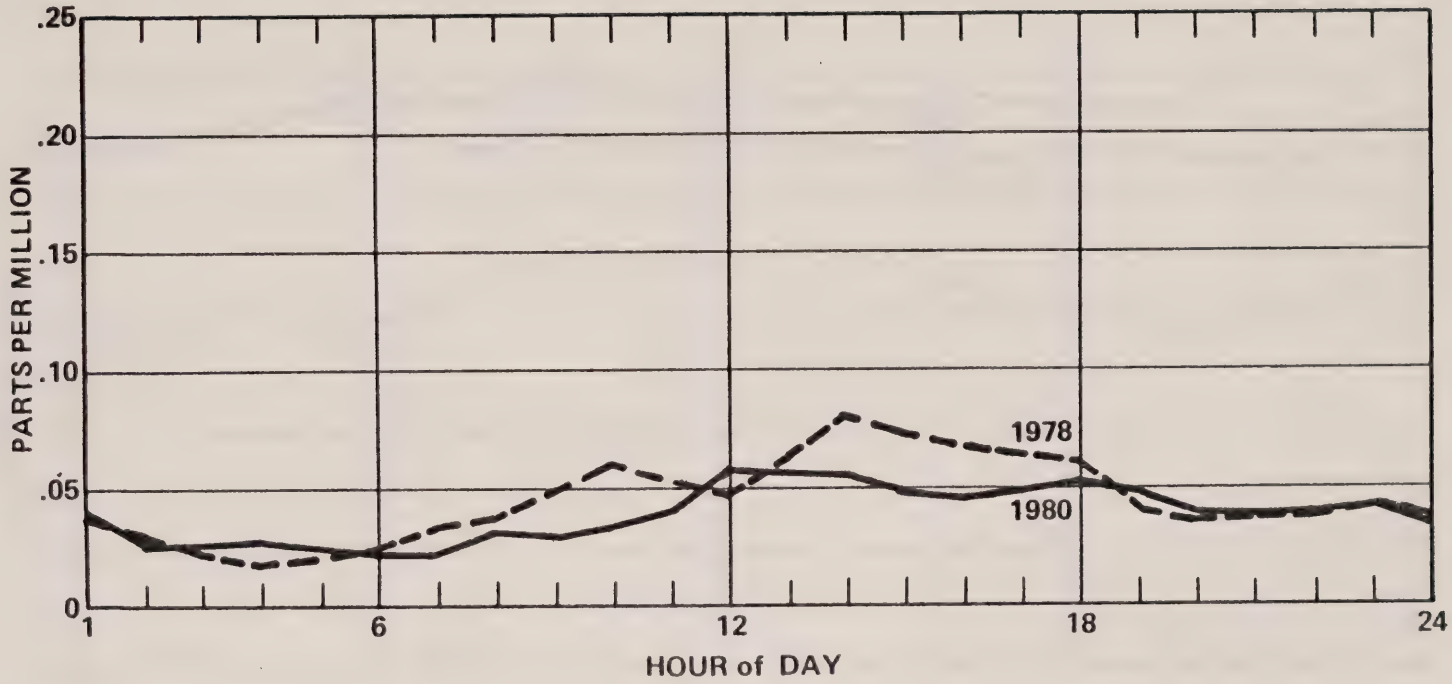


FIG. B.5(b). MEASURED HOURLY AVERAGE NITROGEN DIOXIDE (NO_2) LEVELS AT ARCH ST. SITE ON TUESDAY, 7/25/78 AND ON TUESDAY, 7/8/80.

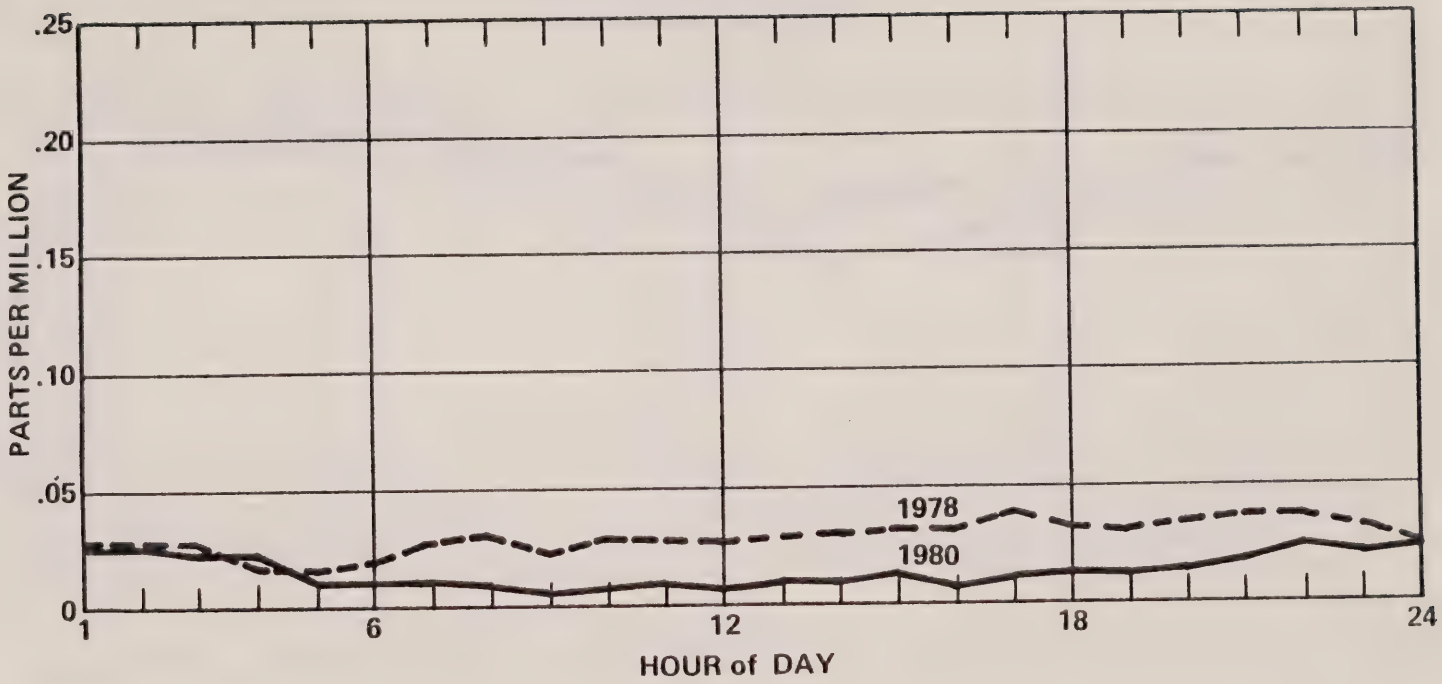


FIG. B.5(c). MEASURED HOURLY AVERAGE NITROGEN DIOXIDE (NO_2) LEVELS AT ARCH ST. SITE ON SATURDAY, 7/15/78 AND ON SATURDAY, 7/12/80.

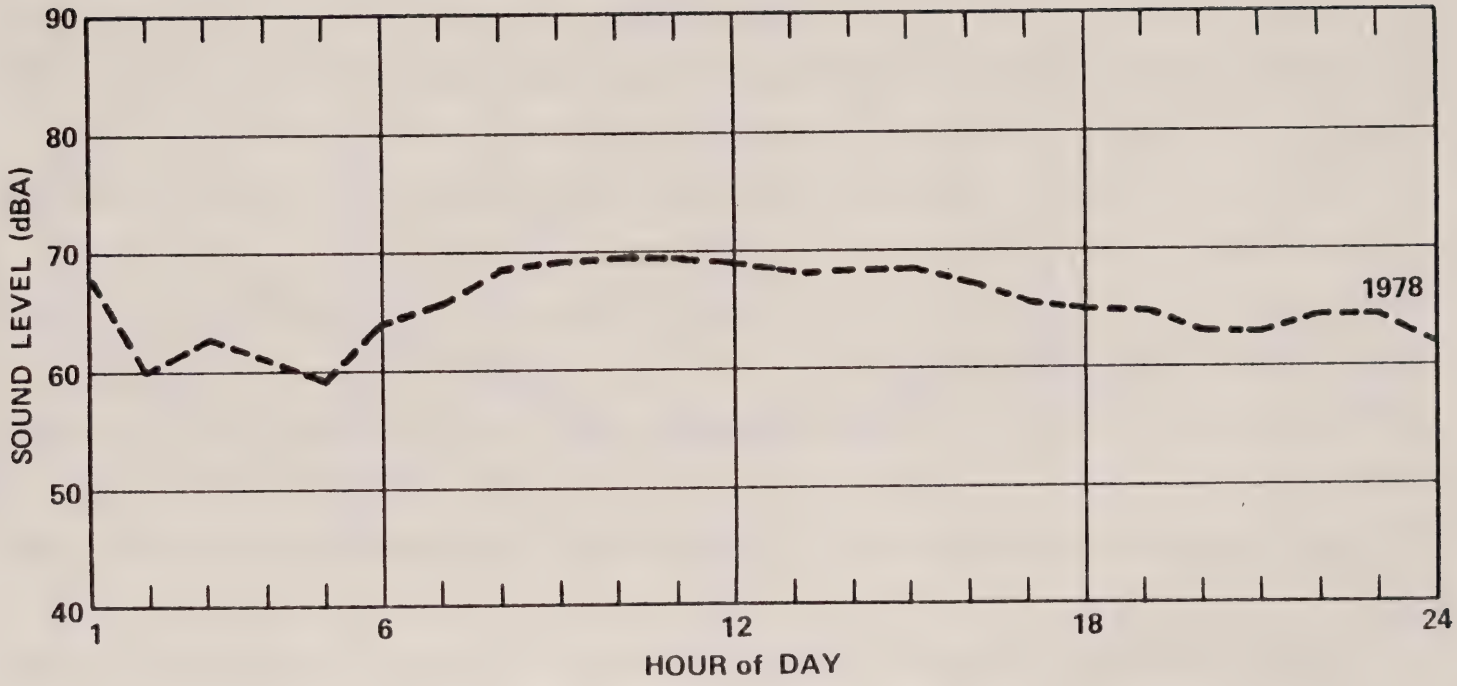


FIG. B.6(a). 24-HR AMBIENT NOISE MEASUREMENTS AT THE POST OFFICE SITE ON THURSDAY, 7/20/78.

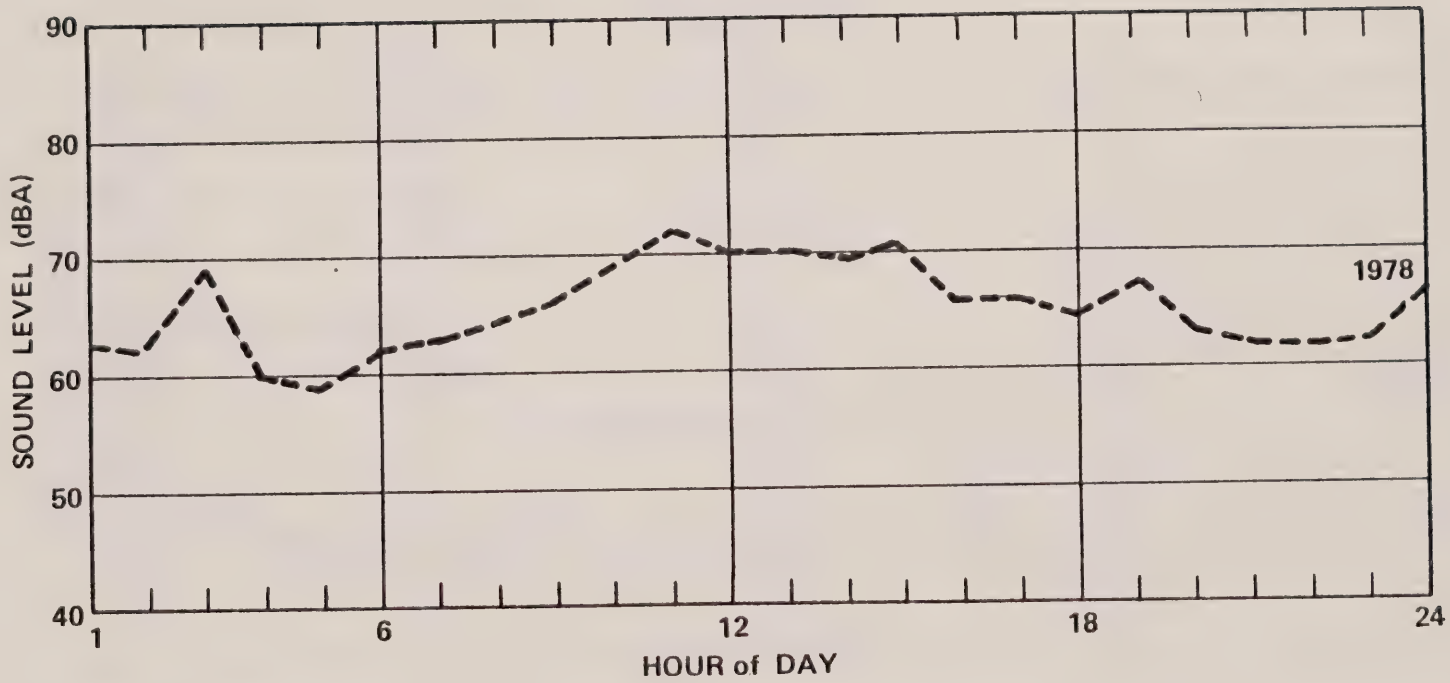


FIG. B.6(b). 24-HR AMBIENT NOISE MEASUREMENTS AT THE POST OFFICE SITE ON SATURDAY, 7/15/78.

slowly in the morning but tended to last longer into the evening. The L_{dn} for these days ranged from 70 to 75 dB. Figure B.7 presents this range of L_{dn} measured at the Post Office site. The average weekday and weekend are presented in Table B.3, along with the maximum L_{eq}. Both the average weekday L_{dn} and the weekend L_{dn} were 71 dB.

There were no measurements made at the Post Office site in 1980 due to major construction in the immediate vicinity of the Post Office site. The influence of the construction equipment and the disruption of traffic flow would not have allowed for valid comparisons of 1978 and 1980 data.

B.3.2 Arch St. site

Sound level data for continuous 24-hr periods were taken at this site during the period 7 July 1978 through 26 July 1978 and from 12 July 1980 to 21 July 1980. The hourly sound level data measured as L_{eq}, are shown in Fig. B.8, for selected days of the week. An examination of Fig. B.8 shows that the range of L_{eq} from 6 a.m. to 6 p.m. was 65 to 75 dB(A). The levels dropped after 6 p.m. and reached a minimum level between 4 a.m. and 5 a.m. Saturday's sound levels during the day were generally lower, although there were two afternoon hours during which levels greater than 70 dBA were recorded.

Figure B.9 shows the weekly trends of the L_{dn} for 1978 and 1980. 1980 L_{dn} levels are lower overall. The average weekday L_{dn} was 72 dB in 1978 and 71 dB in 1980. Average weekend L_{dn} was 69 dB in 1978 and 67 in 1980. Maximum hourly L_{eq}, maximum L_{dn}, and average weekday and weekend L_{dn} for both years are shown in Table B.3.

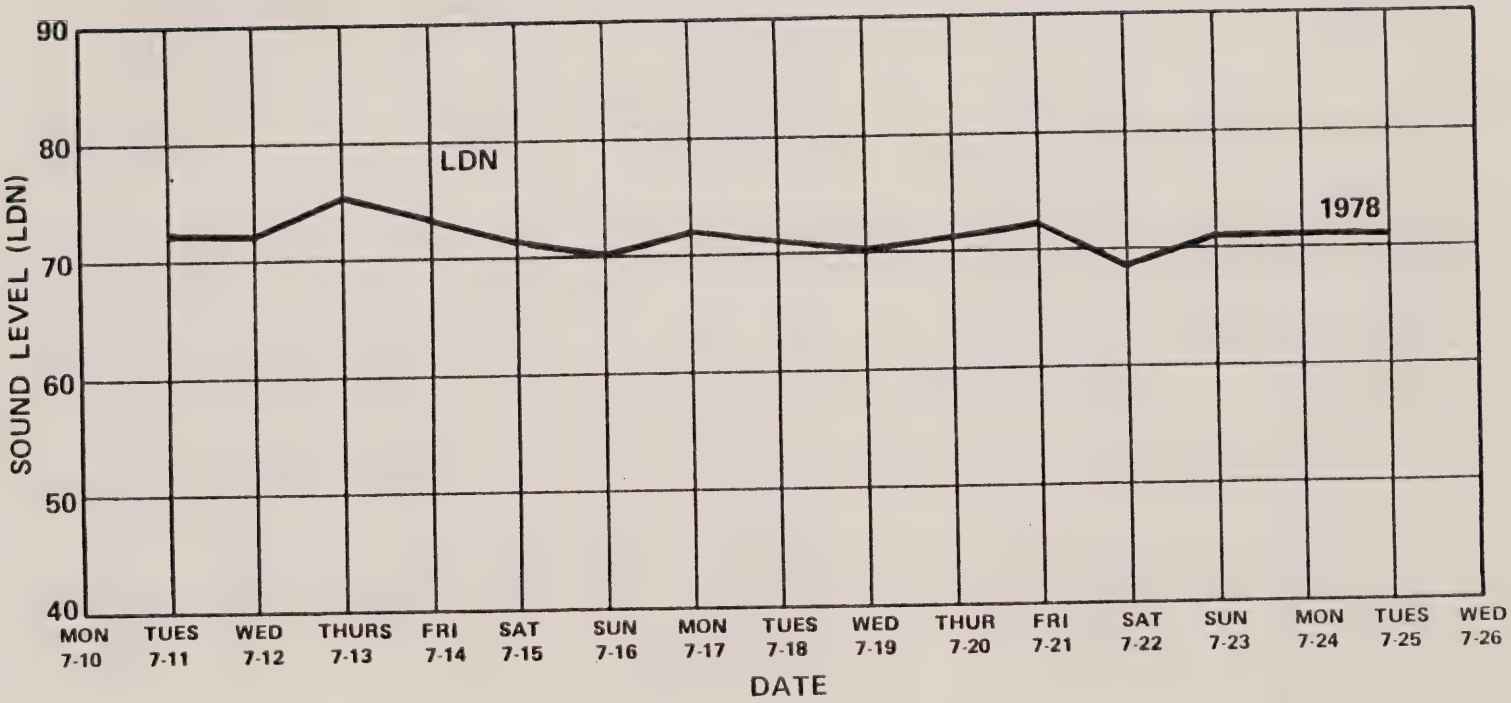


FIG. B.7. MEASURED L_{dn}s FOR POST OFFICE SITE (1978).

TABLE B.3. MEASURED NOISE LEVELS IN THE PROJECT AREA.

	Max. Hourly L_{eq}	Max. L_{dn}	Weekday Average L_{dn}	Weekend Average L_{dn}
Post Office				
1978	76	75	71	71
1980*	--	--	--	--
Arch St.				
1978	84	74	72	69
1980	74	72	71	67
Winter St.				
1978	83	79	77	74
1980	75	74	73	70

*No measurements taken at this site in 1980.

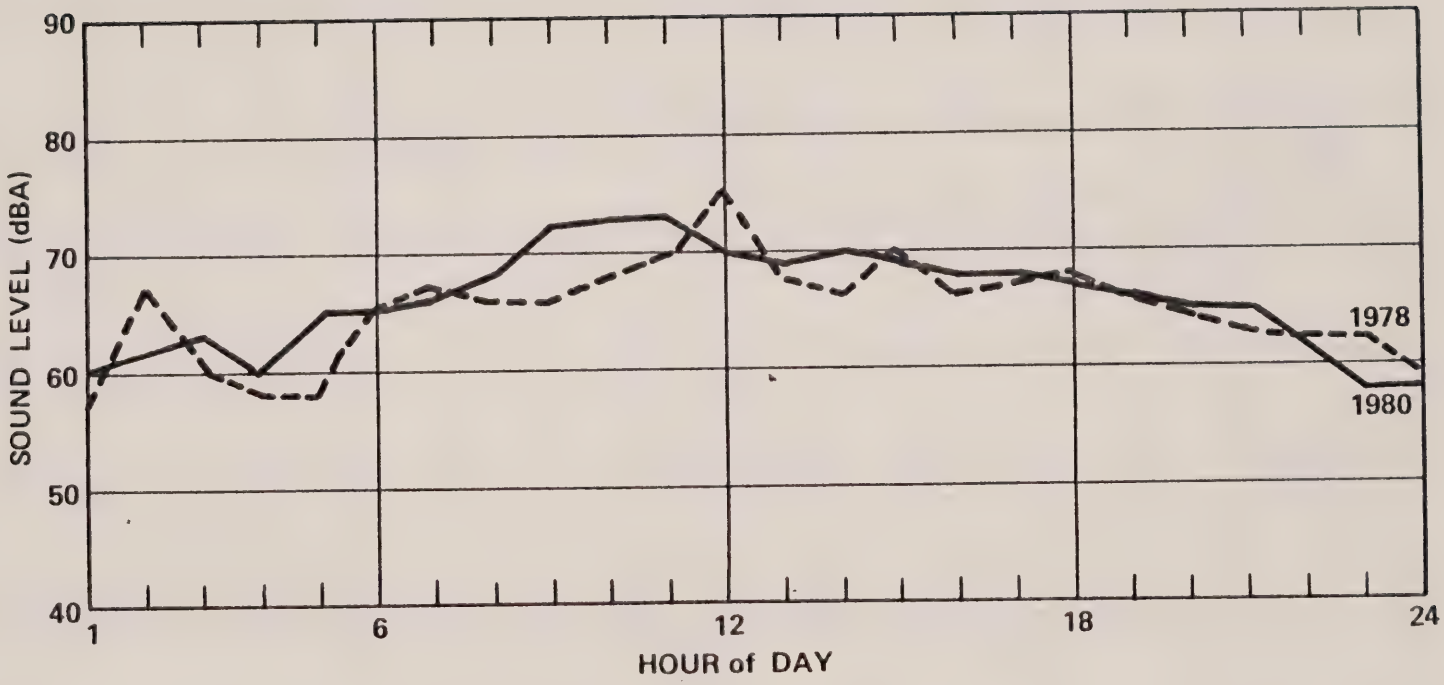


FIG. B.8(a). 24-HR AMBIENT NOISE MEASUREMENTS AT THE ARCH ST. SITE ON WEDNESDAY, 7/12/78 AND ON WEDNESDAY, 7/16/80.

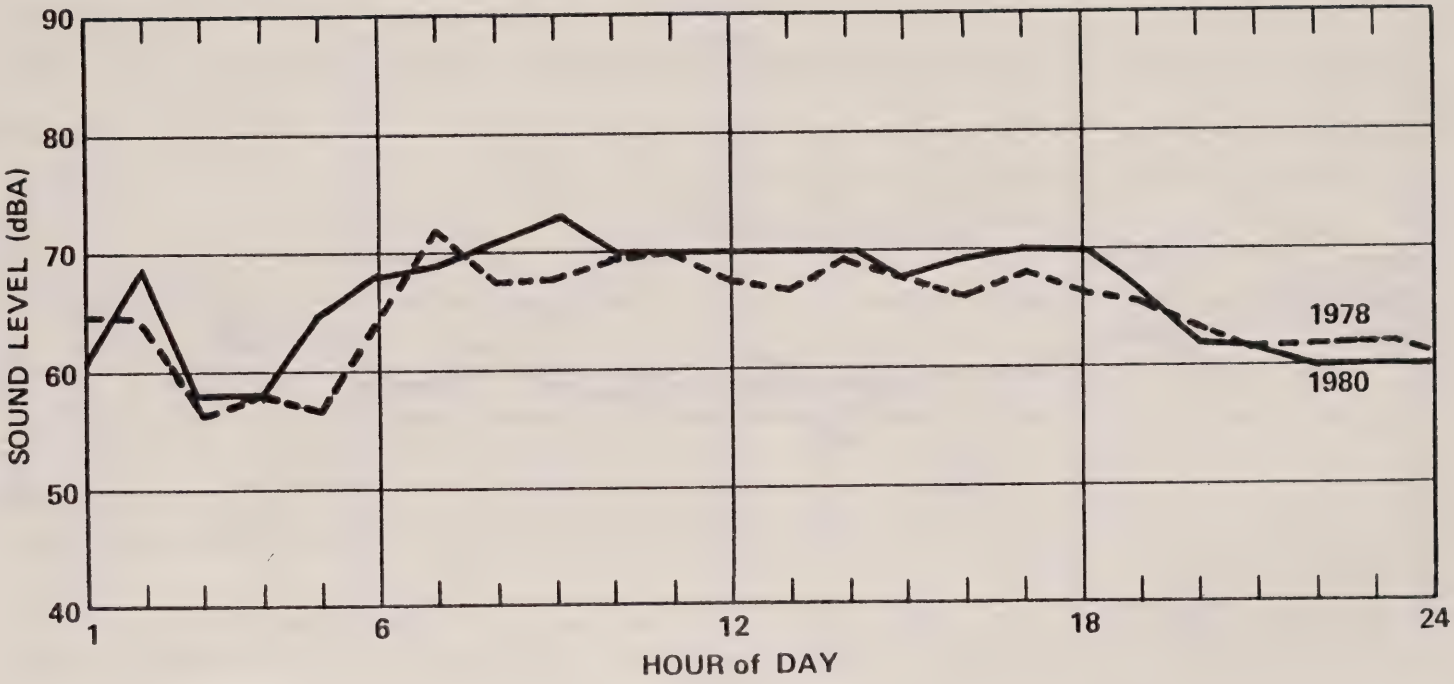


FIG. B.8(b). 24-HR AMBIENT NOISE MEASUREMENTS AT THE ARCH ST. SITE ON THURSDAY, 7/13/78 AND ON THURSDAY, 7/17/80.

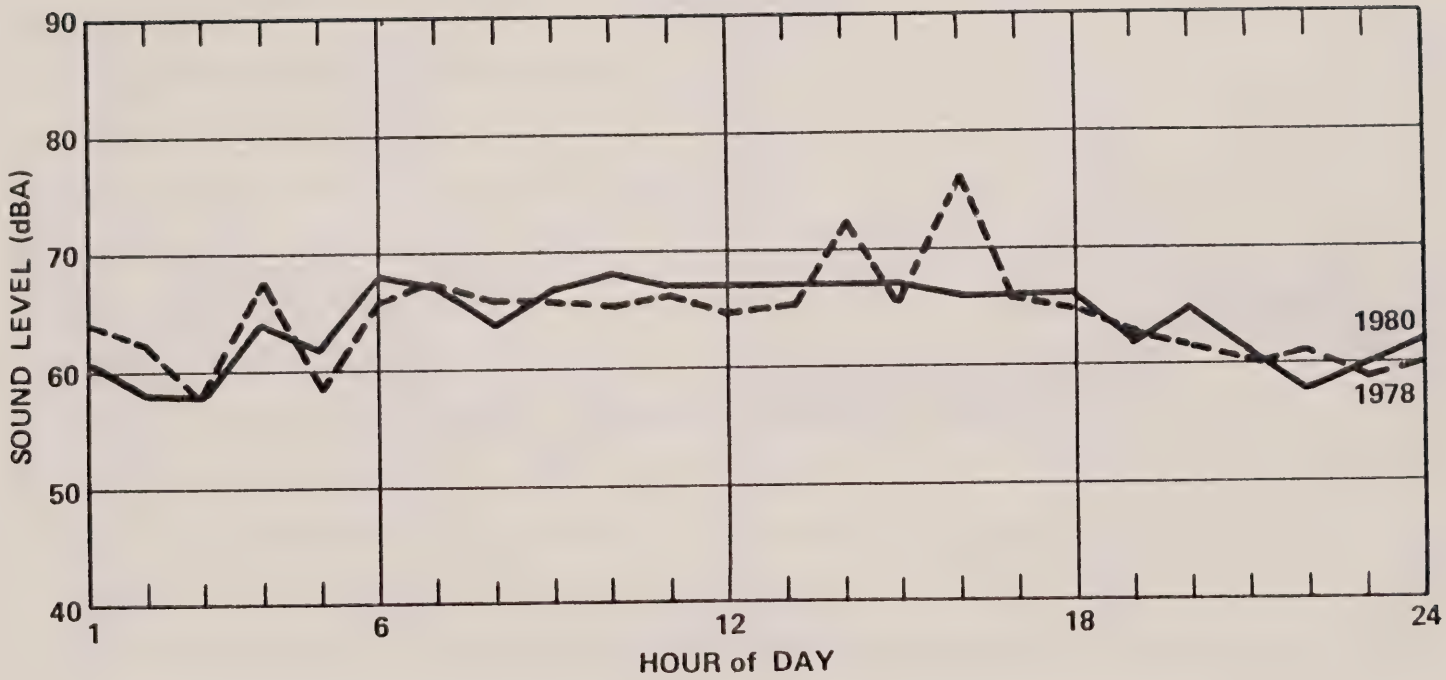


FIG. B.8(c). 24-HR AMBIENT NOISE MEASUREMENTS AT THE ARCH ST. SITE ON SATURDAY, 7/15/78 AND ON SATURDAY, 7/19/80.

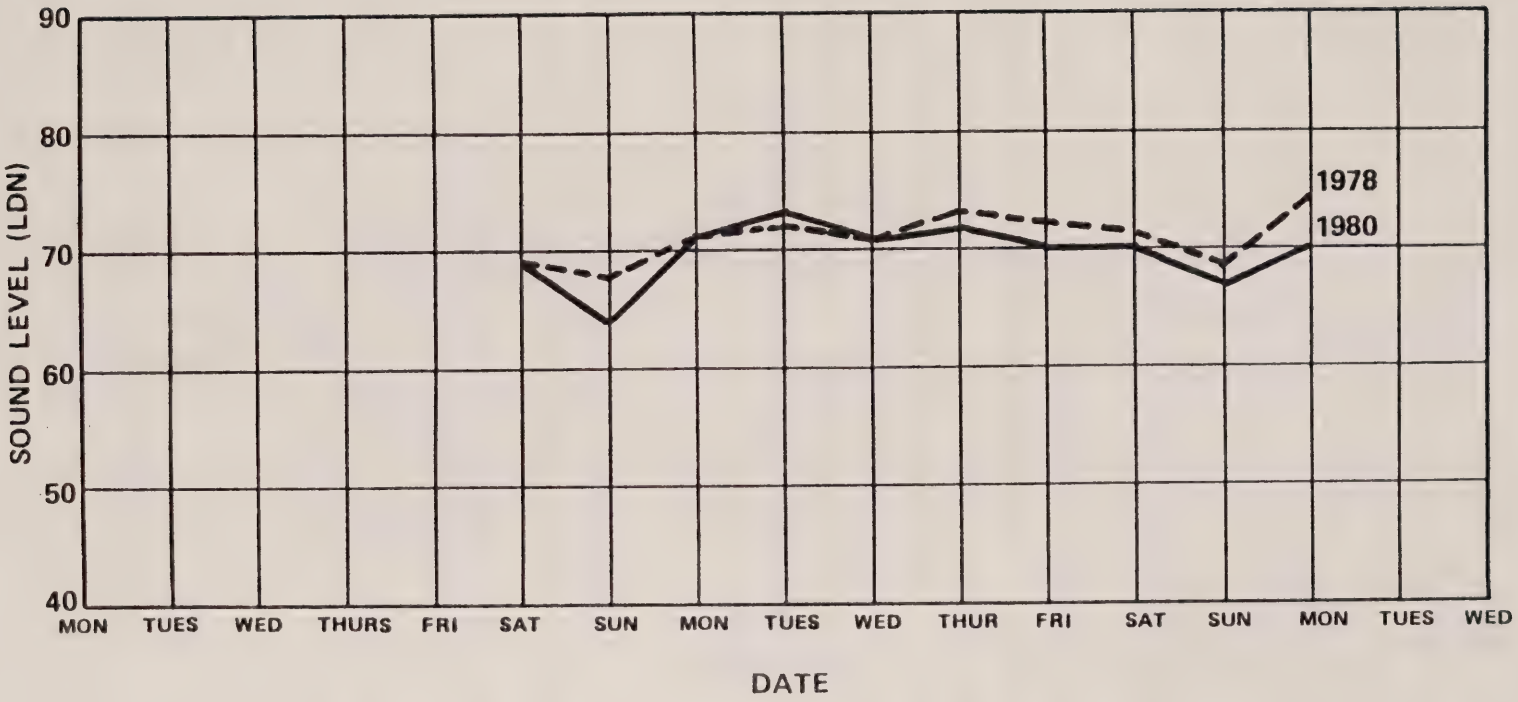


FIG. B.9. MEASURED L_{dn}s FOR ARCH ST. SITE (1978 AND 1980).

B.3.3 Winter St. site

Continuous 24-hr sound level data were collected from 12 July to 26 July 1978 and from 12 July to 21 July 1980. In 1978, weekday hourly L_{eq} between 6 a.m. and 6 p.m. ranged from 70 to 78 dB(A) with a noontime peak. On Saturday, hourly L_{eq}s between 6 a.m. and 6 p.m. were between 65 and 72 dB(A). High levels at 8 p.m. and 10 p.m. are thought to be heavily weighted by single events, perhaps sirens or an alarm.

In 1980, weekday levels were generally lower than those measured in 1978. On a Wednesday and a Thursday, daytime hourly L_{eq}s (between 6 a.m. and 6 p.m.) ranged from 64 to 72 dBA. The noontime peak is no longer present: the peak now occurs at 5 a.m. or 6 a.m. On Saturdays, the daytime levels have generally increased, while the nighttime hours have decreased, with a peak at 3 p.m. Hourly L_{eq}s for a Wednesday, Thursday, and Saturday, comparing 1978 and 1980 levels, are shown in Fig. B.10.

Figure B.11 compares the 1978 and 1980 L_{dn}s by day of the week. In all cases, L_{dn} was lower in 1980 than in 1978.

The average weekday L_{dn} for 1978 was 77 dB; in 1980, it was 73 dB. The average weekend L_{dn} was 74 dB in 1978 and dropped to 70 dB in 1980. These data, along with maximum hourly L_{eq} and maximum L_{dn}, are presented in Table B.3.

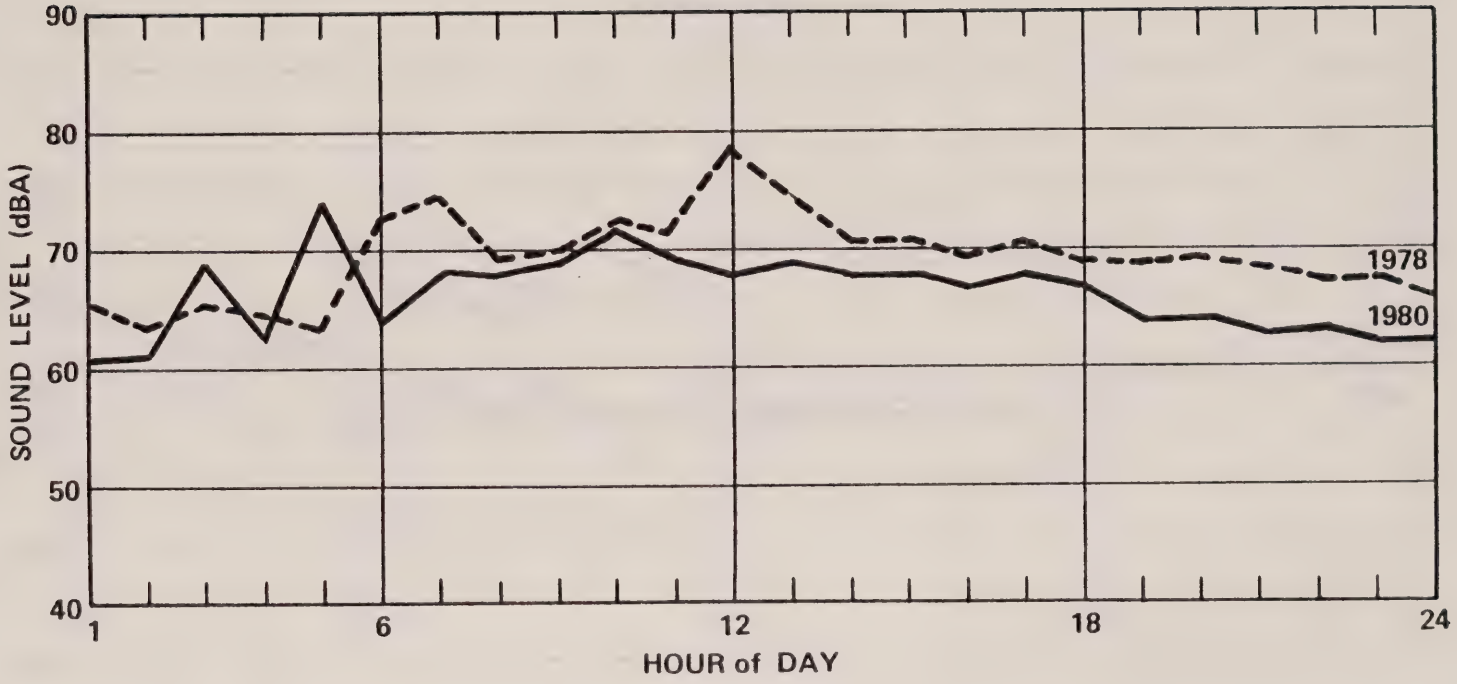


FIG. B.10(a). 24-HR AMBIENT NOISE MEASUREMENTS AT THE WINTER ST. SITE ON WEDNESDAY, 7/19/78 AND ON WEDNESDAY, 7/16/80.

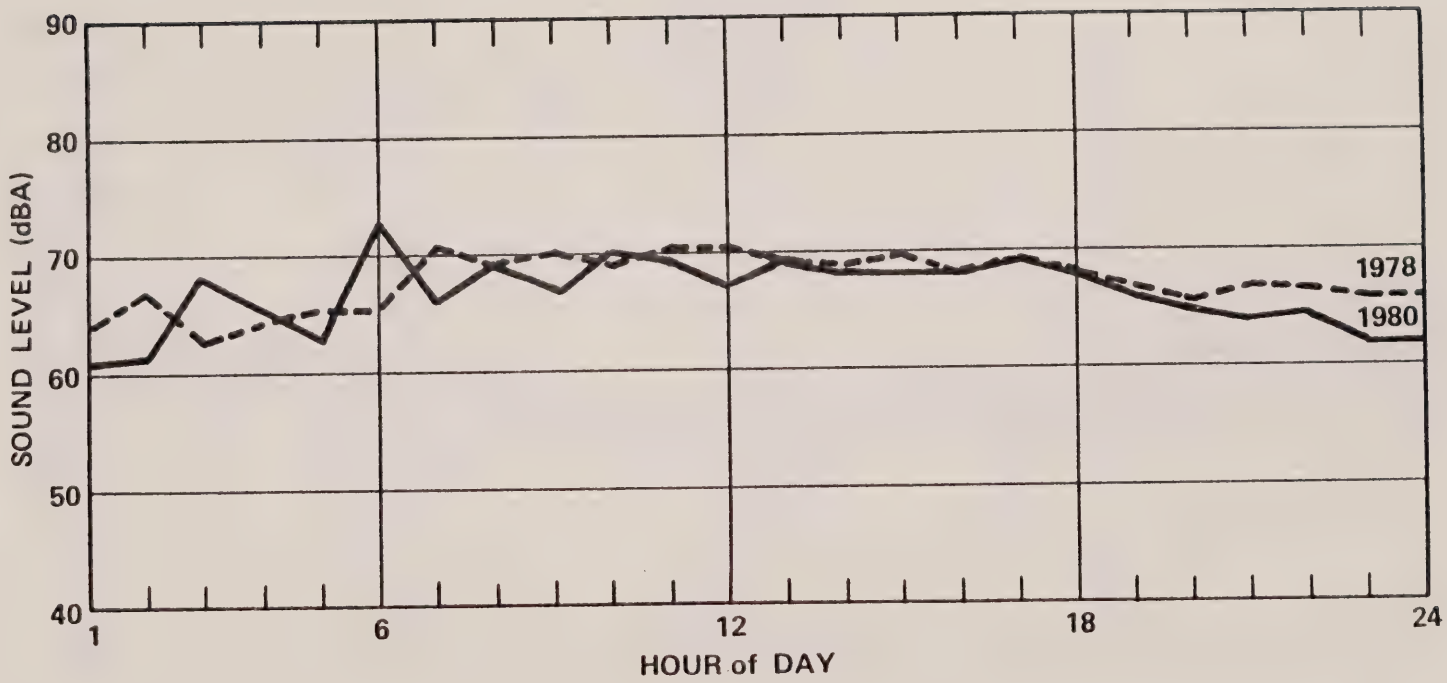


FIG. B.10(b). 24-HR AMBIENT NOISE MEASUREMENTS AT THE WINTER ST. SITE ON THURSDAY, 7/13/78 AND ON THURSDAY, 7/17/80.

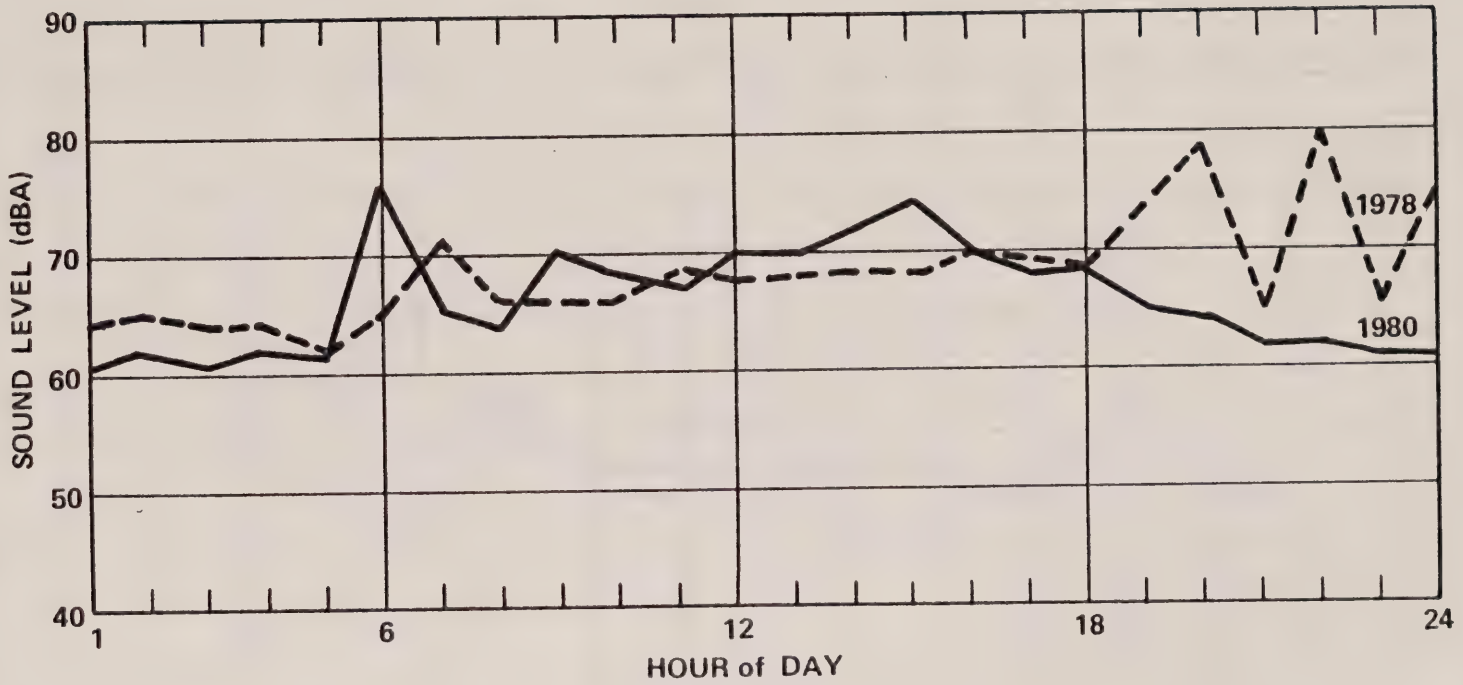


FIG. B.10(c). 24-HR AMBIENT NOISE MEASUREMENTS AT THE WINTER ST. SITE ON SATURDAY, 7/15/78 AND ON SATURDAY 7/19/80.

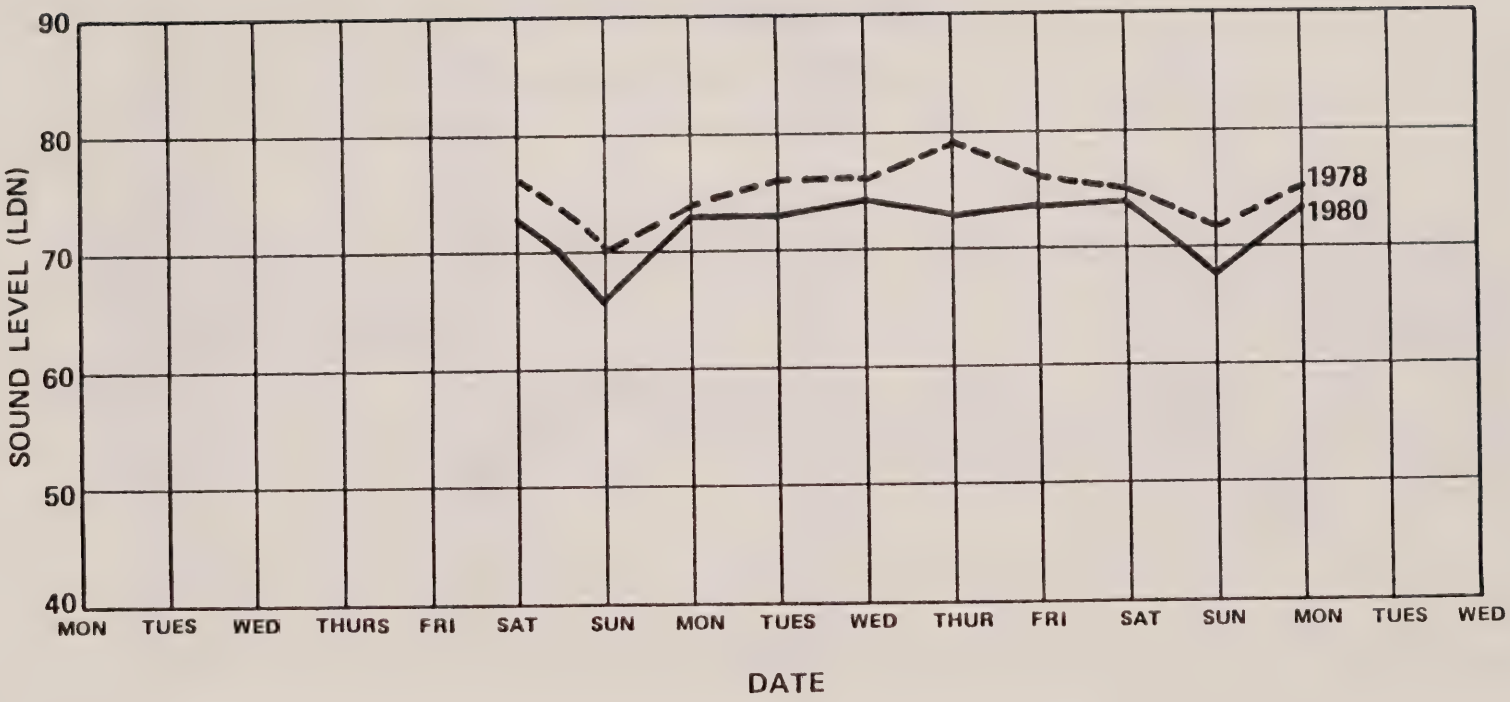


FIG. B.11. MEASURED L_{dn}s AT THE WINTER ST. SITE (1978 AND 1980).

B.4 Wind Speed and Wind Direction

B.4.1 Post Office roof site

Wind speed and direction data were collected at the top of the Post Office Building from 10 July 1978 through 2 August 1978. Data capture rate was estimated at about 68%. Highest wind speeds recorded were about 11 mph. These speeds represented 1-hr average speeds and not transient gusts. The observed frequency data are represented as a wind rose in Fig. B.12. As shown in Fig. B.12, the wind was primarily from the SSW. Calm conditions and wind speeds less than 1 mph together accounted for 1% of the time.

In 1980, wind speed and direction data at this site collected from 2 July to 24 July. Data capture rate was 97%. Highest wind speed recorded was 18 mph. Again, this speed is a 1-hr average speed and not a transient gust. The observed 1980 frequency data are represented as a wind rose in Fig. B.13. The wind was primarily from the South. Calm conditions and wind speeds less than 1 mph together accounted for less than 1% of the time.

Dominant wind direction shifted from SSW in 1978 to South in 1980. The most significant difference affecting the sites was the difference in wind speeds. In 1978, wind speeds over 4 mph accounted for 55% of the time, with speeds over 8 mph accounting for only 7.1%. In 1980, speeds over 4 mph accounted for 92% of the time, and speeds over 8 mph accounted for 43.5% of the time.

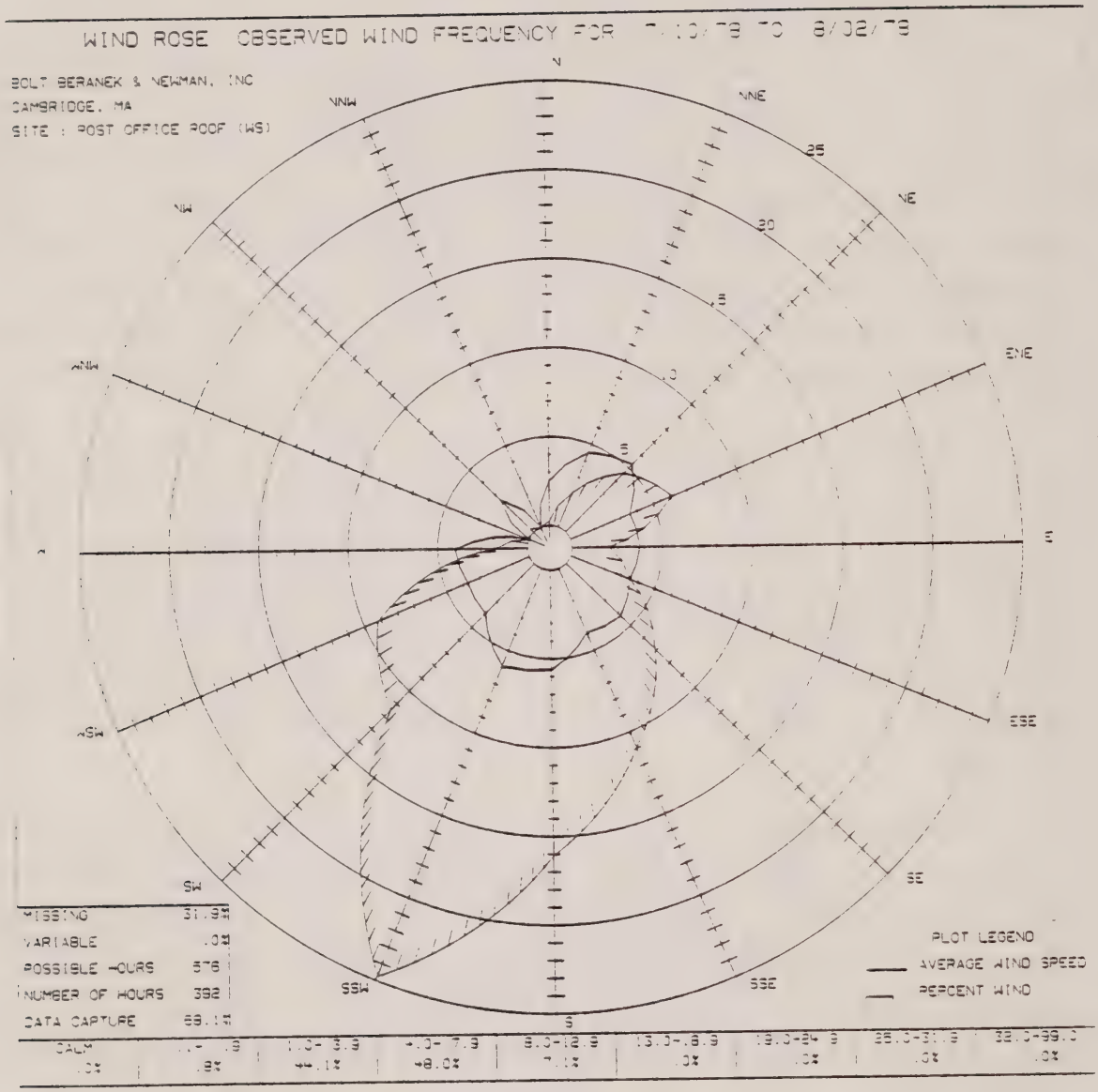


FIG. B.12. WIND FREQUENCY DATA FOR POST OFFICE ROOF SITE (1978).

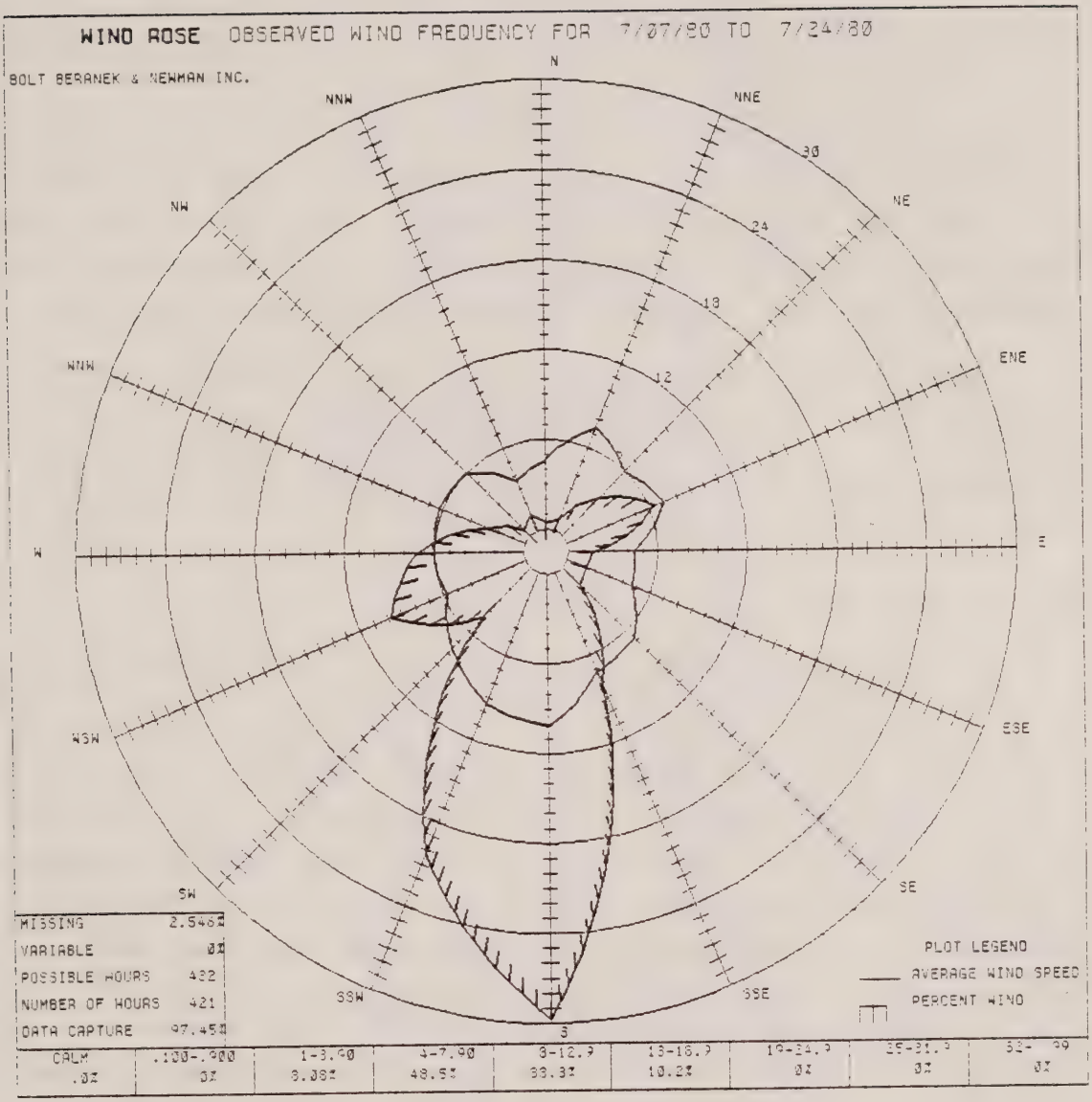


FIG. B.13. WIND FREQUENCY DATA FOR POST OFFICE ROOF SITE (1980).

B.4.2 Post Office cafeteria site

Wind speed and direction data collected at this "street level" site were operated from 10 July 1978 through 26 July 1978. Data capture rate during this period was estimated at 70%. Highest 1-hr average wind speed recorded was about 10 mph. The frequency of occurrence disaggregated by both speed class and direction is shown in the wind rose in Fig. B.14. The predominant wind directions were WSW and NNE. Calm conditions and wind speeds below 1 mph together accounted for 10% of the time.

Because of construction in the vicinity of the Federal Building and its impact on the data, it was felt that no valid comparisons could be made between 1978 and 1980. For this reason, the site was dropped in 1980.

B.4.3 Arch St. site

Wind speed and direction data were collected at this site from 7 July 1978 to 26 July 1978 and from 7 July 1980 to 25 July 1980. In 1978, data capture rate was 89%. The highest 1-hr average wind speed recorded was 4.4 mph. Dominant wind direction was SW. Calm conditions and wind speeds of less than 1 mph accounted for less than 1% of the time. Figure B.15 shows the distribution of wind speed and direction data.

In 1980, data capture rate was 97%. The highest 1-hr average wind speed recorded was 12.6 mph. Wind was primarily (47.8%) from the WSW. Calm conditions and wind speeds of less than 1 mph accounted for less than 1% of the time. Figure B.16 shows the distribution of wind speed and direction data.

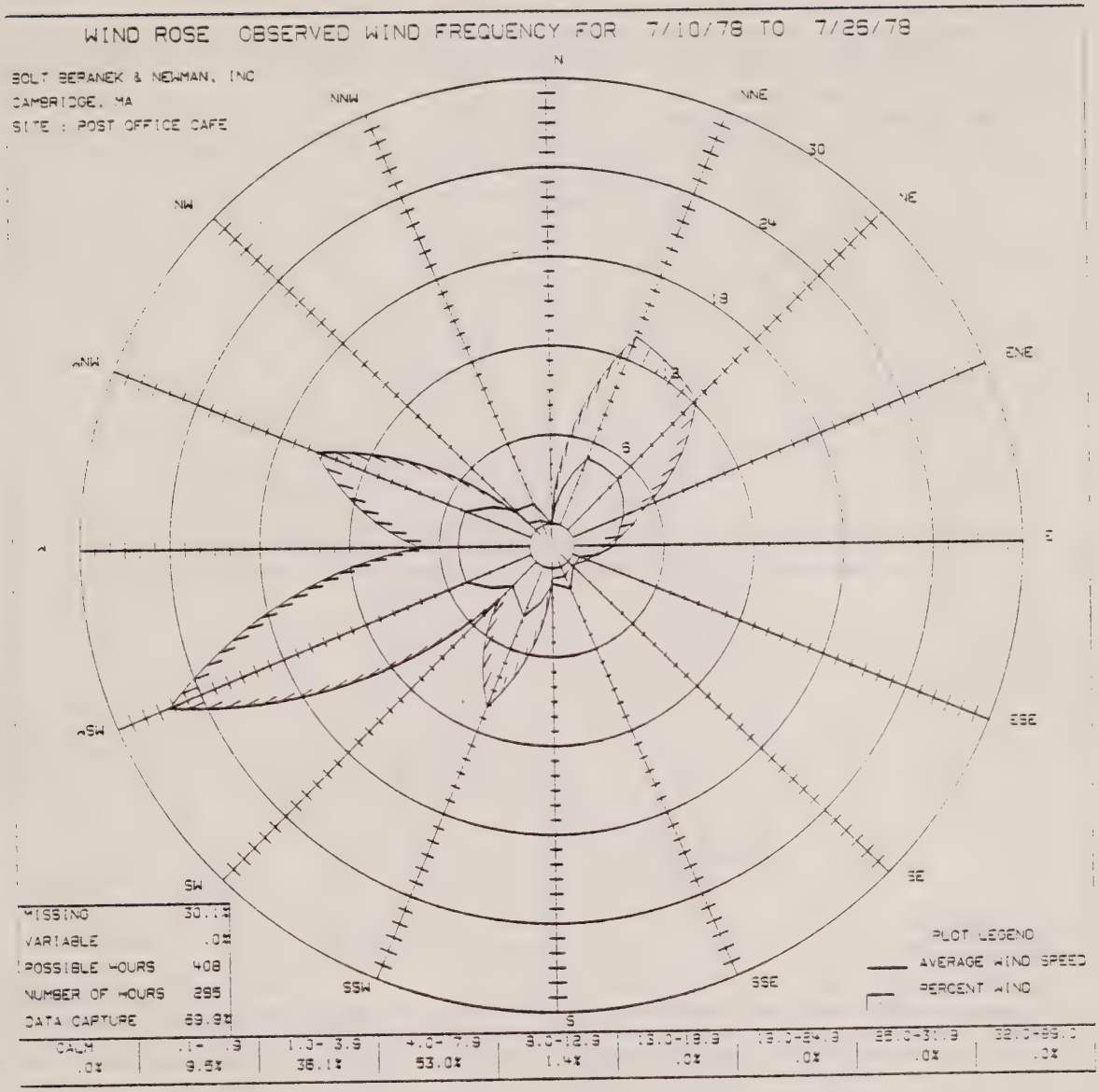


FIG. B.14. WIND FREQUENCY DATA FOR POST OFFICE CAFETERIA SITE (1978).

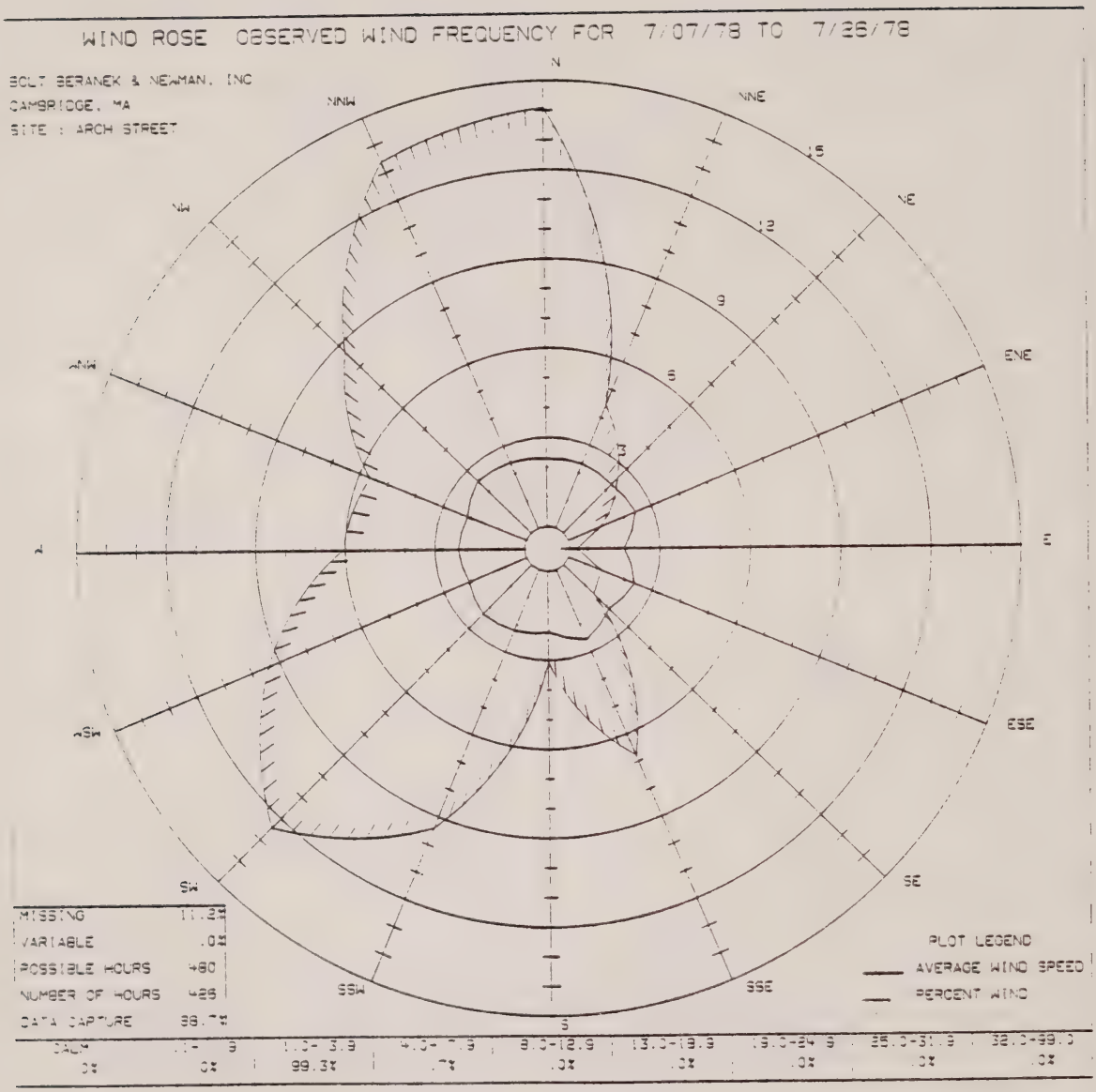


FIG. B.15. WIND FREQUENCY DATA FOR ARCH ST. SITE (1978).

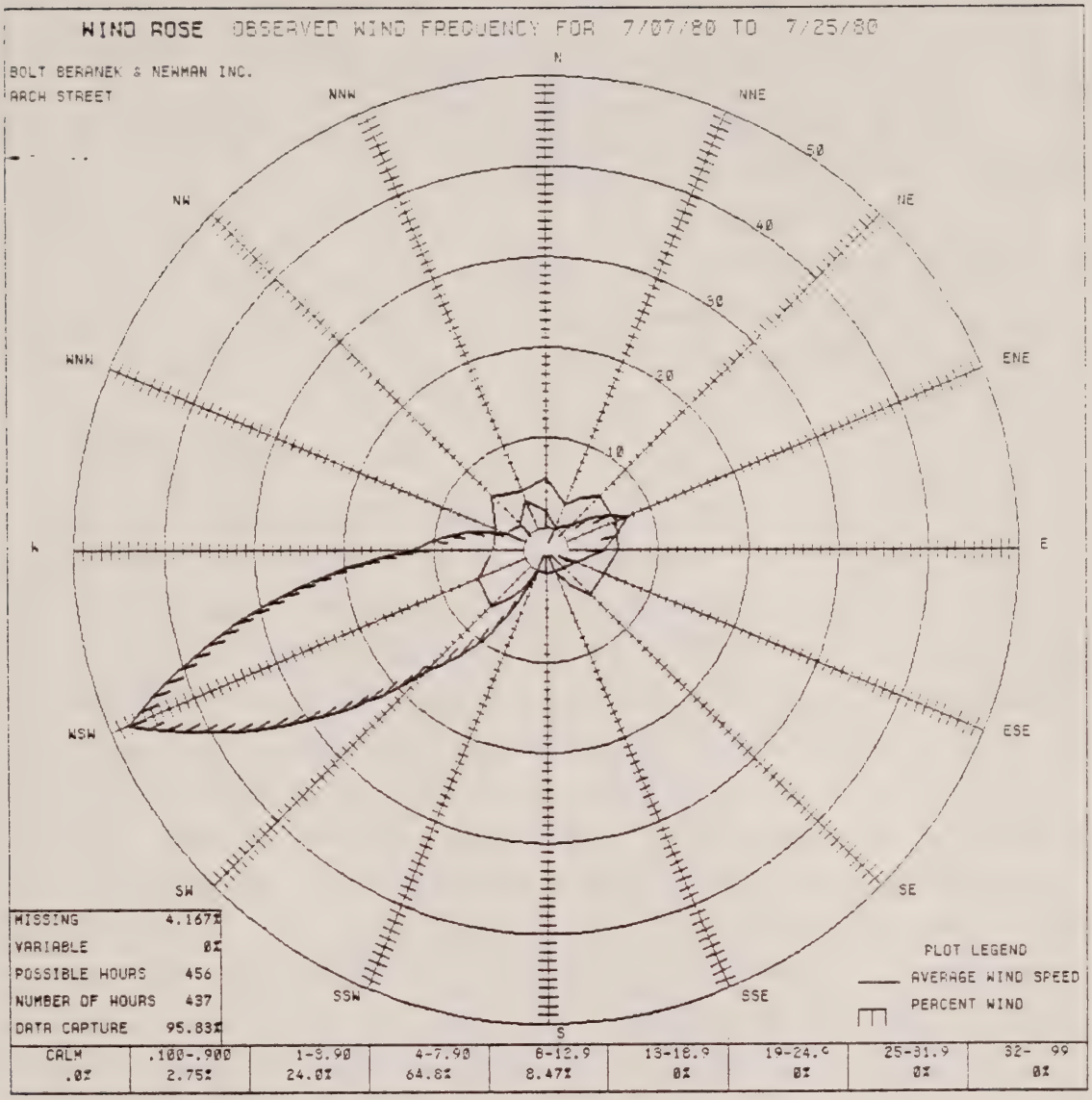


FIG. B.16. WIND FREQUENCY DATA FOR ARCH ST. (1980).

A comparison of the data for 1978 and 1980 shows a dominant wind direction shift from SW in 1978 to WSW in 1980. In 1978, less than 1% of the wind speeds were greater than 4 mph. In 1980, 75% of the speeds were greater than 4 mph, and 8% of the speeds were greater than 8 mph.

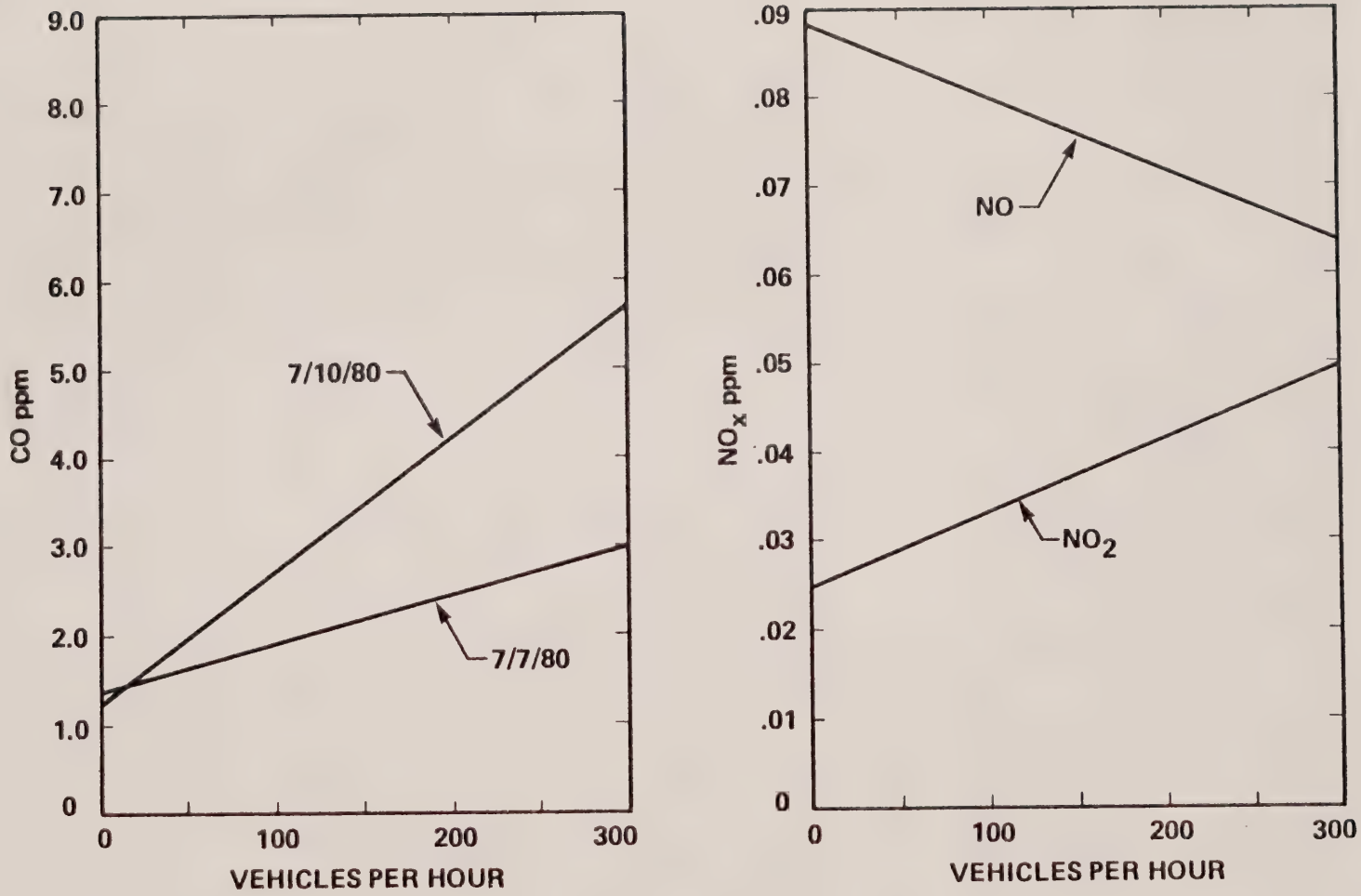
APPENDIX C. CORRELATION ANALYSIS

This section describes the results of some of the correlation analyses that were performed on the various parameters. Because of a lack of concurrent data on traffic volume and measured noise levels, no correlation was attempted for these two variables. No correlation was attempted between noise levels and wind speed because wind speed effects were minimized by design. Consequently, the analyses were restricted to examining the impact of traffic volume and wind speed on ambient concentrations of carbon monoxide (CO) and oxides of nitrogen (NO_x).

C.1 Traffic Volumes

Hourly traffic counts on Arch St. on 10 July 1980 were correlated with measured CO at the Arch St. site. A linear relationship was obtained with a correlation coefficient (r^2) of 0.15. The correlation coefficient is a numerical index that indicates the degree of interdependence between two variables — in this case, the measured CO and the traffic counts. A coefficient of 1.0 implies that the measured CO is very much related to traffic counts, whereas a coefficient of 0.0 implies that the measured CO is unrelated and totally independent of traffic counts. As shown in Fig. C.1, a similar analysis was performed for data taken on 7 July 1980. Again, a positive correlation was obtained, but the correlation (as measured by the value of r^2) is even poorer, with r^2 equal to 0.06.

Similar analyses were performed for NO_x measured at Arch St. With nitric oxide (NO), we found an inverse correlation — i.e., ambient concentration of NO actually went down with increasing traffic volumes. This correlation is not explainable by any deterministic model and may be a reflection of the unusual and very limited data base. The correlation coefficient



(a) CO

(b) NO_x

FIG. C.1. RELATIONSHIPS BETWEEN AMBIENT CARBON MONOXIDE, OXIDES OF NITROGEN, AND TRAFFIC VOLUMES AT ARCH ST.

is less than 0.01, suggesting that little confidence can be placed in this result. With nitrogen dioxide (NO_2), the correlation between traffic volumes and observed NO_2 levels is positive — i.e., NO_2 levels go up with increasing traffic volumes. However, the correlation is again very poor — less than 0.01.

In all cases, we observed that traffic volumes and the measured ambient concentrations of CO and NO_x generally show a positive correlation. However, from the limited data that were compiled, the correlation results are statistically of little value.

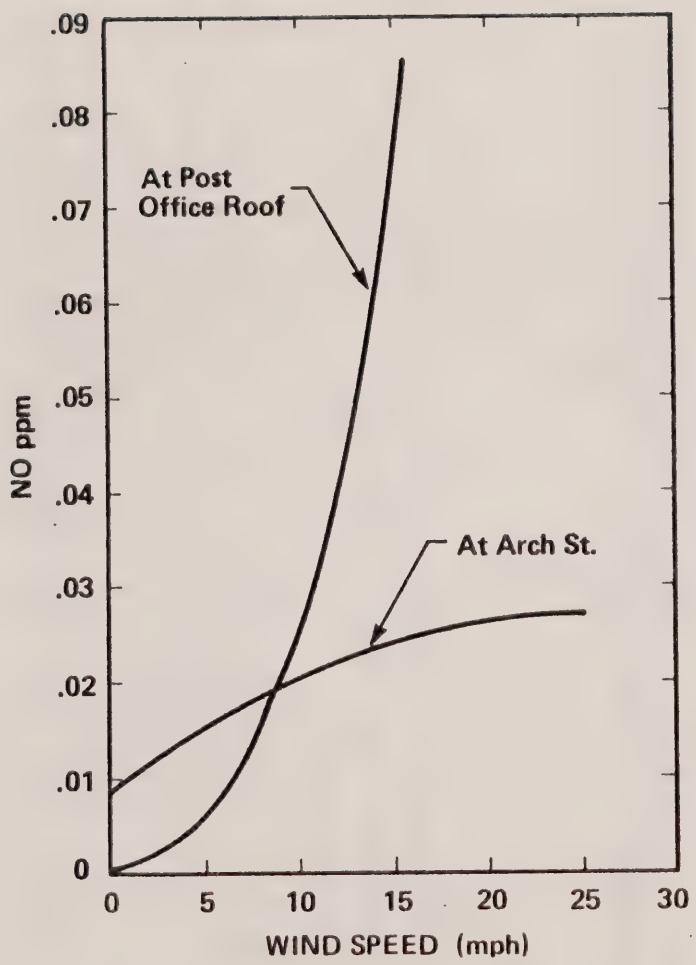
C.2 Wind Speed

The effect of wind speed in open terrain and for simple emission source/receptor environments, has generally been accepted as an inverse relationship. For all of the following correlation analyses, therefore, a power function of the following form is tested:

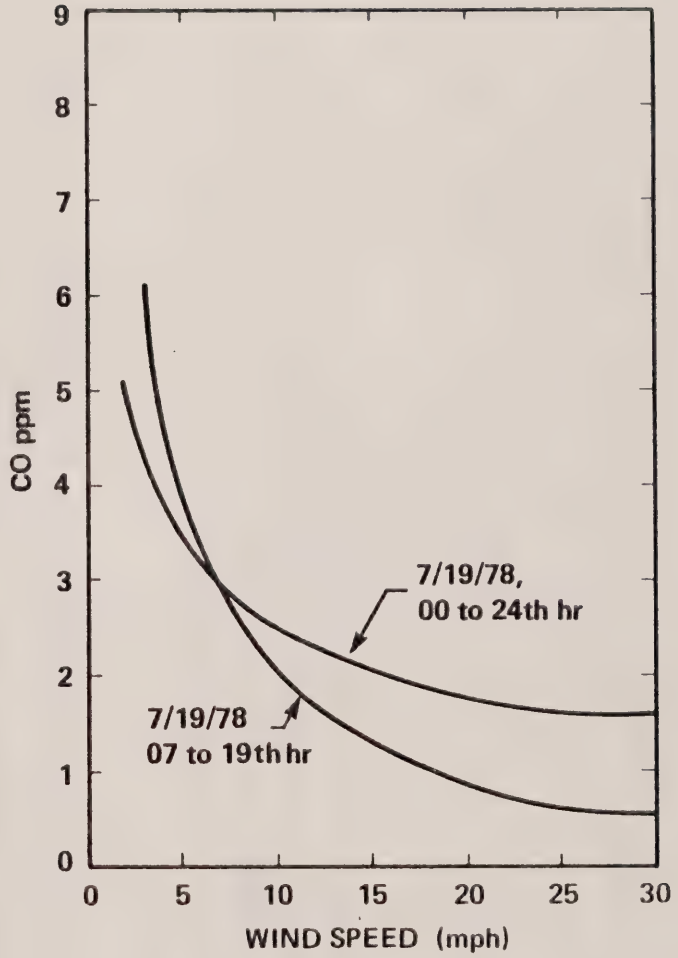
$$y = ax^b ,$$

where y is the dependent variable (such as CO levels), x is the independent variable (such as the wind speed), and a,b are regression coefficients.

Because wind speed was measured at both street level and at rooftop, we tested the sensitivity of the measured concentration as a function of the location of the wind speed monitor. The results for NO are shown in Fig. C.2. Contrary to dispersion theory (for simple open terrain as described above), we found a



(a) NO AT ARCH ST.



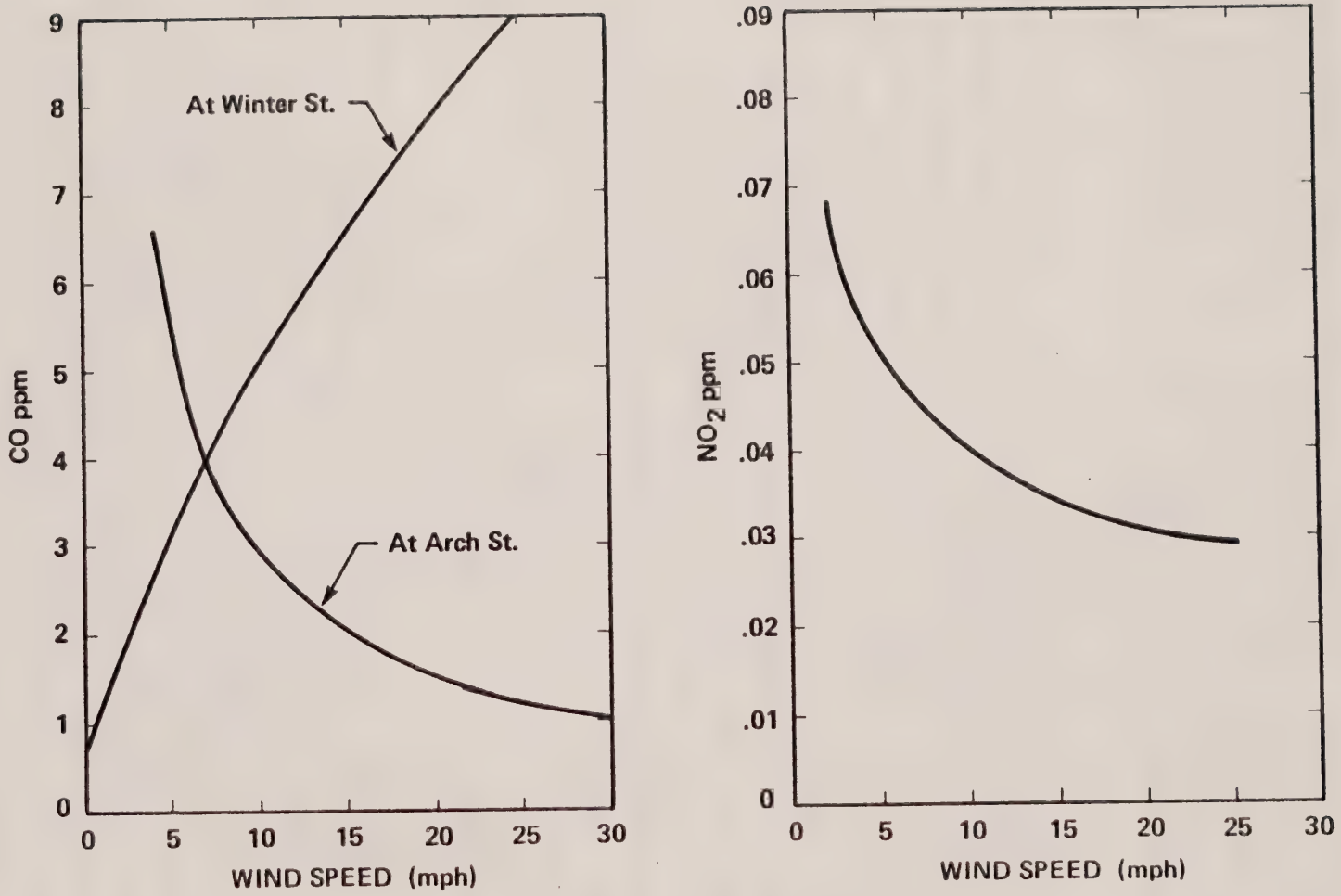
(b) CO AT POST OFFICE.

FIG. C.2. SENSITIVITY ANALYSES FOR SELECTED TIME PERIODS AND WIND SITES.

positive correlation of observed NO vs. wind speed. The regression coefficients are markedly different — depending on which wind site the regression analysis was based. In both instances, the correlation (as measured by r^2) was poor — less than 0.2 for the Post Office roof data and less than 0.02 for the Arch St. wind data.

Correlations between any two variables also appear to vary considerably from day-to-day and selected time periods during the day. Figure C.2 also shows the relationship between ambient CO at the Post Office site on 19 July 1978 and the observed wind speed at rooftop. For the 24-hr period beginning with the 00th hr on 19 July 1978, we obtained an inverse relationship (i.e., CO increases as wind speed decreases) with an r^2 of 0.13. However, when the same regression was performed for the period 07 to 19th hr in the same day (representing hours of higher emission rates and attendant higher concentrations), a better correlation (with an r^2 of 0.55) was achieved. We performed the same tests for 18 July 1978 and found a completely different trend. We found a better correlation (r^2 equal to 0.34) for the 24-hr period than the 07 to 19th hr period (r^2 equal to 0.06).

Figure C.3 shows the regression results for CO at Winter St. and at Arch St. when compared with wind speed measured at the Post Office roof. For the Winter St. results, the correlation is positive even though the correlation coefficient is low (r^2 about equal to 0.1), suggesting that the observed correlation may be meaningless. For the Arch St. results, the measured CO was observed to increase with decreasing wind speed, and a much better correlation coefficient (r^2 approximately equal to 0.54) was obtained. A similar correlation was performed for the observed NO_2 concentration at Arch St. and the wind speed measured



(a) CO

(b) NO_2 AT ARCH ST.

FIG. C.3. RELATIONSHIP BETWEEN AMBIENT CARBON MONOXIDE, NITROGEN DIOXIDE, AND WIND SPEED (FROM POST OFFICE ROOF).

at the Post Office roof. Here again, as shown in Fig. C.3, an inverse relationship between these two variables was formed. The correlation, however, is poor – the r^2 is estimated at less than 0.1.

In summary, we found that observed concentrations of CO and NO_2 vary in some direct proportion to traffic volume that directly impacts on the monitor. However, for NO, the relationship is inverse, suggesting (1) that there are other factors (such as the chemistry of the NO_x species) that may affect this relationship between traffic volume and NO, or (2) that the observed relationship may be unique to that particular limited data set, or (3) that both these possibilities are true. Observed concentrations of CO and NO_2 generally vary inversely with wind speed as a power function. However, because of localized channeling of wind and other changes to the wind field, correlation between observed concentrations and wind speeds at any combination of two sites may become totally inverted and/or be uncorrelated at all sites. Because of these observed limitations, no attempt was made to quantitatively adjust the measured air quality and noise data to make the observed data more comparable between the pre- and the post-construction stages.

APPENDIX D

Performance Specifications for the Monitoring Equipment

The Beckman Model 865 Infrared Analyzer

INTRODUCTION

The Model 865 Infrared Analyzer automatically and continuously determines the concentration of a particular component of interest in a flowing mixture. The analysis is based on a differential measurement of the absorption of infrared energy. The instrument has a wide range of applications, subject only to the limitation that the analysis involve the determination of a single component, which must absorb infrared energy.

The Model 865 Infrared Analyzer is available in two versions: General-Purpose, Figure 1-1; and Explosion-Proof, Figure 1-2. These differ only in physical configuration; *functionally*, they are identical.

Within the analyzer, two equal-energy infrared beams are directed through two optical cells: a flowthrough sample cell and a sealed reference cell. Solid-state electronic circuitry continuously measures the *difference* between the amounts of infrared energy absorbed in the two cells. This difference is a measure of the concentration of the component of interest in the sample. Readout is on a front-panel meter with 0-to-100 scale. In addition, a field-selectable output for a potentiometric (voltage) recorder is provided as standard. A field-selectable output for a current-type recorder or controller is obtainable through use of an optional plug-in circuit board.

A calibration curve can be used to convert meter or recorder readings into concentration values. Alternatively, the analyzer may utilize an optional plug-in linearizer circuit board to equip a given operating range for *linear readout of concentration values* on the meter and on a potentiometric recorder.

For convenient routine upscale calibration, the analyzer may incorporate an optional calibration accessory. Depression of a pushbutton inserts a reflecting window into the sample beam. The window reflects a fixed amount of infrared energy out of the beam, to simulate a specific concentration of the measured component.

As an option, the analyzer may be equipped for *remote* selection of Range 1 or 3.

The electronic circuitry utilizes plug-in printed circuit boards with solid-state components. This feature provides the ultimate in reliability, facilitates servicing, and permits the inclusion of various options, such as current output, by addition of the appropriate boards.

SPECIFICATIONS

ACCURACY
1% of full scale.

SPAN DRIFT*
±1% of fullscale in 24 hours.

ZERO DRIFT*
±1% of fullscale in 24 hours.

AMBIENT TEMPERATURE RANGE
30°F to 120°F (−1°C to 49°C).

LINE VOLTAGE
115 ±15 volts rms.

LINE FREQUENCY
50/60 ±0.5 Hz.

POWER CONSUMPTION
400 watts.

ELECTRONIC RESPONSE TIME
(0 TO 90% OF FULLSCALE)
Switch selection of fast or slow response.
FAST switch position provides 0.5-second response (optional 1-second response obtainable by clipping jumpers).
SLOW switch position provides 2.5-second response.

OUTPUT
Standard (Potentiometric)
0 to 10, 0 to 100 millivolts, 0 to 1, 0 to 5 volts d.c. (field-selectable).
Optional (Current)
4 to 20 and 10 to 50 milliamperes, d.c. (field-selectable).
or, Linearized (Potentiometric)
0 to 10, 0 to 100 millivolts, 0 to 1, 0 to 5 volts d.c. (field-selectable).

CATALOG NUMBERS AND CASE ELECTRICAL CLASSIFICATIONS
194501 General-Purpose Model 865 Infrared Analyzer: general-purpose case; accessory air purge kit designed for ISA Type Z.
194502 Explosion-Proof Model 865 Infrared Analyzer, designed to meet Class I, Group B/D, Division 1 requirements.

*Performance specifications based on ambient temperature shifts of less than 20 Fahrenheit degrees (11 Centrigrade degrees) at a maximum rate of 20 Fahrenheit degrees (11 Centrigrade degrees) per hour.

The Beckman Automatic Zero/Span Standardization Accessory for Gas Analyzers

FEATURES

Built-in twenty-four hour timer capable of initiating both full calibration sequences and separate zero sequences at any desired times within the twenty-four hour period. In addition, calibration sequences can be initiated by an externally supplied logic signal or by manual command vis pushbutton.

Auto zero standardization point may be offset from zero by adding a selected resistor to the zero-correction circuit.

Out-of-range alarm lights warn operator when gas analyzer requires adjustment.

The ±15 volt power in the supply unit is capable of powering up to two other units, saving cost in systems applications.

Status lights notify operator when calibration sequence is occurring.

Built-in sample-and-hold amplifier will display last process value during calibration sequence for control applications.

SPECIFICATIONS

ZERO, SPAN RESOLUTION
±0.5% of fullscale.

ZERO CORRECTION RANGE
±15% of fullscale, minimum.

SPAN CORRECTION RANGE
±10% of fullscale, minimum.

AMBIENT TEMPERATURE RANGE
50°F to 110°F.

OUTPUTS
10 millivolts, 100 millivolts, 1 volt, 5 volts Potentiometric Standard, 4 to 20-milliamperes Isolated Current Optional.

INPUT
0 to 5 volts fullscale, either polarity.

SAMPLE-AND-HOLD DECAY RATE
Less than 1% of fullscale per 20 minutes.

LINE VOLTAGE
100 to 130 volts rms, 60 Hz
200 to 260 volts rms, 50 Hz.

CALIBRATION SEQUENCE TIMES
2.5, 5, or 40 minutes, selectable.

The Monitor Labs Nitrogen Oxides Analyzer
Model 8440E

INTRODUCTION

The Monitor Labs Nitrogen Oxides Analyzer Model 8440E is a gas phase chemiluminescence detection device which performs a continuous dry analysis of Nitric Oxide (NO), Nitrogen Dioxide (NO_2), and NO_x. Its operation is based on the chemiluminescence of an activated NO_2 species (NO_2*)produced by the chemical reaction between ozone and NO (1). A photomultiplier tube (PMT) measures the chemiluminescent emission intensity level.

The Model 8440E design constitutes an advancement in Nitrogen Oxides Analyzer technology. It is achieved primarily by a design concept of employing dual detectors or reaction cells (2): a separate cell for the NO and the NO_x channels (3). A dual channel analyzer ensures that all readings produced by the analyzer are operating in real time domain. The Model 8440E employs a reaction cell/optical chopper designed to obtain optical and electronic stability and ISOFLO pneumatics to control flow rate of the gas streams. These design features improve the sensitivity, accuracy, and stability of the analyzer. Figure 1-1 shows the overall Nitrogen Oxide Analyzer Model 8440E schematic and some standard options. Sample and air enter and leave the reaction chamber through the pneumatic network. The chemiluminescent emission from the reaction cell is interrupted and transmitted alternately to a photomultiplier tube 35 times per second by an optical chopper. A phase sensitive amplifier processes the PMT signal which is subsequently converted to a voltage output for a recorder and DAS unit.

A dual-module packaging concept is utilized. The Analyzer module contains the reaction cells and PMT assemblies, the ISOFLO flowrate control assembly, PMT power, signal processing electronics, the front panel readout display and DAS and recorder outputs. The Sample Conditioner module contains the preliminary pneumatic network consisting of a sample filter, sample and ozone rotameters, a catalytic converter, ozone generator assembly, an ozone scrubber, a reaction cell vacuum regulator, and vacuum pump. Also available are the optional zero/span valves and timer. Separation of the 8440E into two modules is of great advantage for obtaining stable, reliable performance and ease of service and maintenance.

(1) A.Fontijn, A.J. Sabadell, and F.J. Ronco, Anal. Chem., 42, 575 (1970)
(2) U.S. Patent No. 3, 967, 933.
(3) A.L. Budd, A Dual Channel Approach to Chemiluminescent Analysis of NO_2 and NO, 20th National Instrument Society of America Analysis Instrumentation Symposium, Pittsburgh, PA., 1974.

SPECIFICATIONS

Zero Instability	Less than 0.1% full scale/yr., ±3°C from Cal. Temp., maximum temperature coefficient 0.025%/°C
Span Instability	Less than ±1%/day or ±2%/14 days from all sources, ±5°C from Cal. Temp Maximum temperature coefficient of span 0.2%/°C
Lag Time	Less than 5 sec. from step change at input
Repeatability*	±1% NO and NO_x and ±1.4% NO_2 output
Operating Temperature	10°C to 40°C
Detection Limit	2ppb for NO, NO_2, NO_x, on response time setting 4
Measuring Ranges	Select one set. (A) 0.2, 0.5, 1.0, 2.0, 5.0 ppm F.S. (B) 0.1, 0.5, 1.0, 5.0, 10.0 ppm F.S. (C) 0.05, 0.1, 0.5, 1.0, 5.0 ppm F.S.
Response Time	Four settings, switch-selectable

Setting	Percent of final answer 64%	90%	99%
1	1 sec.	2.3 sec.	4.6 sec.
2	5 sec.	12 sec.	23 sec.
3	20 sec.	46 sec.	92 sec.
4	1 min.	2.3 min.	4.6 min.

Signal Outputs	Two separately buffered analog signal outputs for each channel, NO, NO_x, NO_2, plus an unbuffered front panel analog signal test output which is switched to output the signal of the channel being indicated by the front panel meter.
Rear Panel	Barrier strip (≡6 spade-lugs required)
"REC"	Standard 0-100MV, output impedance 100Ω; Optional (SO) 0-10MV, 0-1V, 0-5V, 0-10V
"DAS"	Standard 0-1V, output impedance 2.5KΩ; Optional (SO) 0-10MV 0-100MV, 0-5V, 0-10V
Front Panel	Binding Posts 0-1V only, Impedance 1KΩ
Status Output	Range, Time Constant, Function, Warning, Power Failure
Sample	Less than 500cc/min. each channel nominal
Ozone	80cc/min each channel nominal
Support Gas Required	Ambient Air
Sample Line	Stainless steel and Teflon
Power	105-125 VAC, 50-60 Hz @ 400 VA Optional, 100 VAC, 230 VAC
Weight	32 kg (70 lbs.)
Dimensions (H x W x D)	2 modules, each 22.2 cm x 44.1 cm x 44.1 cm, 8¾" x 17" x 17" May be stacked, set side-by-side or rack mounted

*Limit of plant test equipment. Theoretical repeatability less than 0.1%.

ORDERING INFORMATION

Basic Models

All models include Teflon filter, NO, NO, Ozone flow meters and one instruction manual. Specify measuring range set and converter.

8440B Bench Mounted
8440R Rack Mounted with slides

Options

SR Standard Ranges, specify set A, B, or C
DA NO Difference Amplifier
CM Molybdenum Converter
CS Stainless Steel Converter
SO Standard output levels, specify if other than 100 mv and 1V desired
SP Phosphoric Acid Scrubber
SR Phosphoric Acid Scrubber Refills, one dozen
PE Power European, 230 VAC, 50 Hz (external transformer)
PJ Power Japan, 100 VAC, 50 Hz (external transformer)
AV One Hour Averager, external module and 6 foot cable
EK Expendables Kit, includes supply of pump diaphragms, ozone scrubber, lamps, fuses and lab gas drier refill material
FI Field Installation, Continental U.S.
IM Instruction Manual
DO TTL compatible or contact closure status output

Specifications and options subject to change without notice

The Monitor Labs PERMACAL Dynamic Calibrator

The Monitor Labs PERMACAL Dynamic Calibration System, Model 8500, is designed to provide precise concentrations of various common pollutants in otherwise purified air. The system can operate from its own internal air pump and filtering system or from external air, or other gas source. Permeation devices and/or chemical generators operating in a temperature controlled environment are used to provide precise amounts of pollutant compounds, which are diluted by flow controlled purified air in order to provide precise concentrations of pollutant compounds for calibrating a wide variety of air quality monitoring and measuring devices. The Model 8500 is specifically designed for producing concentrations suitable for ambient air quality monitoring instruments.

SPECIFICATIONS

Output

		P/N	Nominal Rate	PPM @ 1ℓ/M dilution
SO_2	A	850C0185	300 ng/min	0.1
	B	850C0186	100 ng/min	0.03
NO_2	A	850C0187	700 ng/min	0.7
	B	850C0188	200 ng/min	0.2
H_2S		850C0189	200 ng/min*	0.15
O_3	A	850C0167		8.0 **
	B	850C0167		3.0
NO		850C0221	***	2.0

* requires nitrogen dilution for this channel only.

** highest output range 4

*** assumes gas to be diluted is 200 ppm NO in prepurified nitrogen (provided by user) and minimum dilution (higher concentration available by using higher concentration NO).

Calibration accuracy - ±5% relative

Calibration Method:

NO_2 - Chemiluminescent by comparison to gas phase titration (G.P.T.)

SO_2 - Electrochemical by comparison to NBS standard reference material.

H_2-S- Oxidation to SO_2 and electrochemical comparison to NBS standard reference material.

O_3 - Chemiluminescent by comparison to neutral buffered potassium iodide.

NO - Chemiluminescent by comparison to gas phase titration flow by mass flowmeter.

Dilution air source -	Ambient air filtered thru Ozone Generator, Reaction Volume and activated charcoal. Filters are 1" dia. by 4" long.
Zero Air Flow Capacity (total)	9ℓ/min
Dilution Flow Measurement	Ball flotation flow meter with 150 mm graduated scale and needle valve to adjust flow. One flow meter per channel.
Dilution flow range	500 cc/min to 4000 cc/min
Dilution flow accuracy	±5% at N.T.P. (See Section 4)
Flow Meter Calibration	at N.T.P. vs. mass flow meter (Curve provided)
Temperature Control	±0.1°C or better
Temperature readout	Optional etched stem thermometer
Factory set temperature	50°C
Ambient temperature range	15°C to 35°C
Power	115 VAC,50/60 Hz, 300VA
8500R	19" (48.3 cm) x 10-3/4" (27.3 cm) H X 14" (35.6 cm) deep.
8500	8-1/2"(11.0cm) W X 10" (25.4 cm) H X 14" (35.6 cm) deep.

NO DILUTION OPTION

NO flow control method	Adjustable pressure against a fixed restrictor.
Regulator	Single stage, stainless steel 0-30 psig
Gauge	Helicoid 0-30 psi
Gauge accuracy	±2%
Gauge repeatability	±0.5%
Flow range	0.4 cc/min to 10 cc/min nominal
Restrictor	stainless steel capillary
Dilution range	10,000:1 to 50:1

Specifications for the Energetics Science Ecolyzer

Dimensions	13" x 7 3/8" x 7 3/8"
Weight	9 lbs.
Sensor	Electrochemical
Rise Time	25 sec.
Analytical Reproducibility	±1% of Full Scale
Zero Drift	0.5% of Full Scale in 24 hrs.
Span Drift	1% of Full Scale in 24 hrs.
Noise	±0.2% of Full Scale
Linearity	±1% of Full Scale
Minimum Detectable Sensitivity	1 ppm
Sampling Rate	700 cc/min.
Ambient Temperature Range	0° to 40°C (32° to 104°F)
Temperature Compensation	Built in thermistor compensation.
Relative Humidity Range	5% to 95% RH
Readout	Panel Meter 0-100 ppm CO, 100 divisons full scale, mirrored * Recorder output 0-1V (Recorder Optional)
Electronics	All solid state on printed circuit boards.
Calibration	Once a day with known standard of CO.
Sensor Life	Four (4) months in use.
Power	Electronics: Four (4) Nicad "C" cells Pump: One (1) Nicad "D" cell. Batteries automatically recharged from 120VAC, 60Hz power source.
Interference Equivalent	⩽1.0 ppm on the following.

CH_4	10,000 ppm	NO_2	12 ppm
NH_3	1,000 "	C_3H_8	5 "
SO_2	500 "	NO	1.5 "
H_2	48 "	C_2H_4	0.5 "
H_2S	30 "	C_2H_2	0.3 "

The MRI Mechanical Weather Station Model 1071

The Mechanical Weather Station is a self-contained complete system, compact in overall size and weight with the ability to sense and simultaneously record up to five important climatological parameters. The functional objectives of the Station are: easy transportation to all locations uncomplicated field installations, prolonged periods of operation without inspection or attendance of any kind; no outside power sources required; and operational capability over the widest possible ranges which might be encountered in basic research by a data gathering system.

The rugged utility of the MWS is matched by the high sensitivity of each separate function. Reliability and accuracy of the Wind Direction, Speed, Air Temperature, and Rainfall Systems measure ±2%. Good resolution of recorded data -- black marking on white moisture-resistant chart paper facilitates interpretation. Reasonable initial and negligible operating costs make the MWS a practical instrument for a variety of studies.

SPECIFICATIONS

Wind Direction

Damped 33-1/2" aluminum vane

Delay Distance = 8 feet (50% recovery)
Damping Ratio = 0.5 to 0.6
Starting Threshold = less than 0.75 mph
Overall Accuracy = ±1% full scale

Wind Run (Speed)

Fast response aluminum cups

Flow Coefficient = 7.90 feet/rev
Flow per recording traverse = 10 miles
Response Distance = 18 feet (63% recovery)
Starting Threshold = Less than 0.75 mph
Overall Accuracy = ±2%

Temperature

Shielded bimetal coil sensor

Range L = -90°F to +60°F
Range H = -30°F to +120°F
Note: Range L or H selectable by field adjustment
Absolute Accuracy = ±3°F
Relative Accuracy = ±1°F

Rainfall (Optional)

Low Inertia Tipping Bucket

7.86" I.D. Collector, 24" high
Accuracy: ±1% at 2" per hr.
-2% at 3" per hr.
-10% at 10" per hr
Resolution = 0.01" per recording step
7.95 cc water = one tip

Relative Humidity (Optional)

Range 0% to 100% R.H.
Accuracy ±3%

Batteries

Temp. above +20°F	Four "D" size flashlight batteries - approximate life of 65 days
	Four Eveready E-95 run for 4 months
Temp. at -20°F	Four Eveready E-95 run for 3 months
Temp at -40°F	Four Eveready E-95 run for 2 months

The BBN Model 614 Noise Monitor

The BBN Model 614 Portable Noise Monitor is a sound level meter that measures, calculates and prints out A-weighted sound pressure levels with slow dynamic response (as defined in ANSI S1.4 - 1971). It prints out HNL, L_{dn}, CNEL and relevant time information. Standard options are available for processing of single event information with print out capabilities for SEL, L_{eq}, MNL, time or other parameters required by Federal, State or Local requirements.

The Model 614 automatically prints out the HNL or L_{eq} once every hour and the CNEL and L_{dn}, every 24 hours. At any time, the operator can command a printout of the current sound level or current SEL or average level of HNL, CNEL or L_{dn}, without interruption of the on-going computing process.

Special analysis mode includes sound exposure level or average level of Single Events, such as a flyover. It provides a printed three line summary which includes the start time, stop time, threshold, calculated noise level and maximum noise level of the single event.

The special analysis modes also include automatic noise sampling and SEL or L_{eq} calculation at discrete time interals of 10 sec., 1, 10 min., and 1, 10, 24 hours.

MODEL 614 SPECIFICATIONS

Sound Level Meter

Input Impedance:	121 K ohms in parallel with 1500 pF
Recommended Source Impedance:	4K ohms or less
Voltage Range:	-100 dBV to +10 dBV
Gain Adjustment Range:	Internal adjustment for microphone/preamp sensitivities of -36 to -44 dB re 1V/N/M². Optional front panel control for extended range of -15 to -45 dB re 1V/N/M².
Power Available to External Microphone Preamplifiers:	± 10 Vdc to 10mA +17 Vdc at 15mA (current limited)
Microphones:	BBN Model 368 with preamp. (Max. SPL over 130 dB and drive for a 100 ft. cable). GR preamp with compatible GR and B&K microphones.
Input Connector:	Bendix Pygmy PT series with 10-6S insert. (Adapters available for other microphones such as GR and B&K.)
Frequency Response:	A-weighted per ANSI S1.4-1971
Dynamic Response of Detector:	Slow per ANSI S1.4 - 1971
Electrical Noise Floor:	-100 dBV.
Clipping Level:	+10dBV re input.
Detector Type:	True RMS

Analog to Digital Converter

Range:	10 to 150 dB
Resolution:	0.2 dB
Sampling Period:	0.5 sec

Timing

Source:	Quartz-crystal oscillator
Accuracy:	±10 sec per day

Microcomputer

Type:	Intel 4040
Program Memory:	up to 3584 words (PROM)
Data Memory:	up to 8192 bits (RAM)
Control:	via 16 key keyboard on panel plus separate "Enter" key.

Printer

Type:	Drum impact
Number of Columns:	21
Number of Characters:	16 (numeric and punctuation except for rightmost 2 columns which have letters and symbols)
Paper:	3½ inch wide adding machine roll paper. Part no. 50050
Ribbon:	Two color, red and black. Part no. 50051

Power System

Input Voltage:	16 to 21 Vdc
Peak Current:	2.5 A
Average Current:	80 mA (not printing)
Power Connectors:	2 ea Switchcraft D4M
Battery Pack:	BBN 800 recommended (two w fit in 614 case) or external 18V battery.
Battery Meter:	Expanded scale (15.6 to 20.6V) meter on front panel.
Protection:	3A fuse in 614, 10A fuse in 800 battery pack. Reverse polarity protection dio All regulated supplies are curr limited.
Low Voltage Shutdown:	Automatic, prevents acquisitio inaccurate data and prevents o discharge of battery.
Floating Charging:	The two power connectors are wired so that a power pack plug into one connector can be char via the other connector.
Life:	7 days minimum with two batte packs. (Continuous operation.)

Standard Package: HNL (L_{eq} 1 hr.), L_{dn}, CNEL or L_{eq} 24

Special Analysis

Package 1: Includes Sound Exposure Level or L_{eq} of single ev such as flyovers. The printed three line summary includes the start time, stop time, threshold, calculated noise level and maxi noise level of the single event.

The analysis modes also include automatic noise sampling and or L_{eq} calculation at discrete time intervals of 10 sec.; 1 or 10 mi 1, 10 or 24 hrs.

Other Special Analysis Packages Available.

Any of the above functions may be monitored at any time wit interruption of the calculations.

Options

Option 02 Statistical Analysis Package

Automatic L% calculation and printout of six levels such as: L_m L_1, L_{10}, L_{50}, L_{90}, L_{99}. Other percentile levels available on spe order.

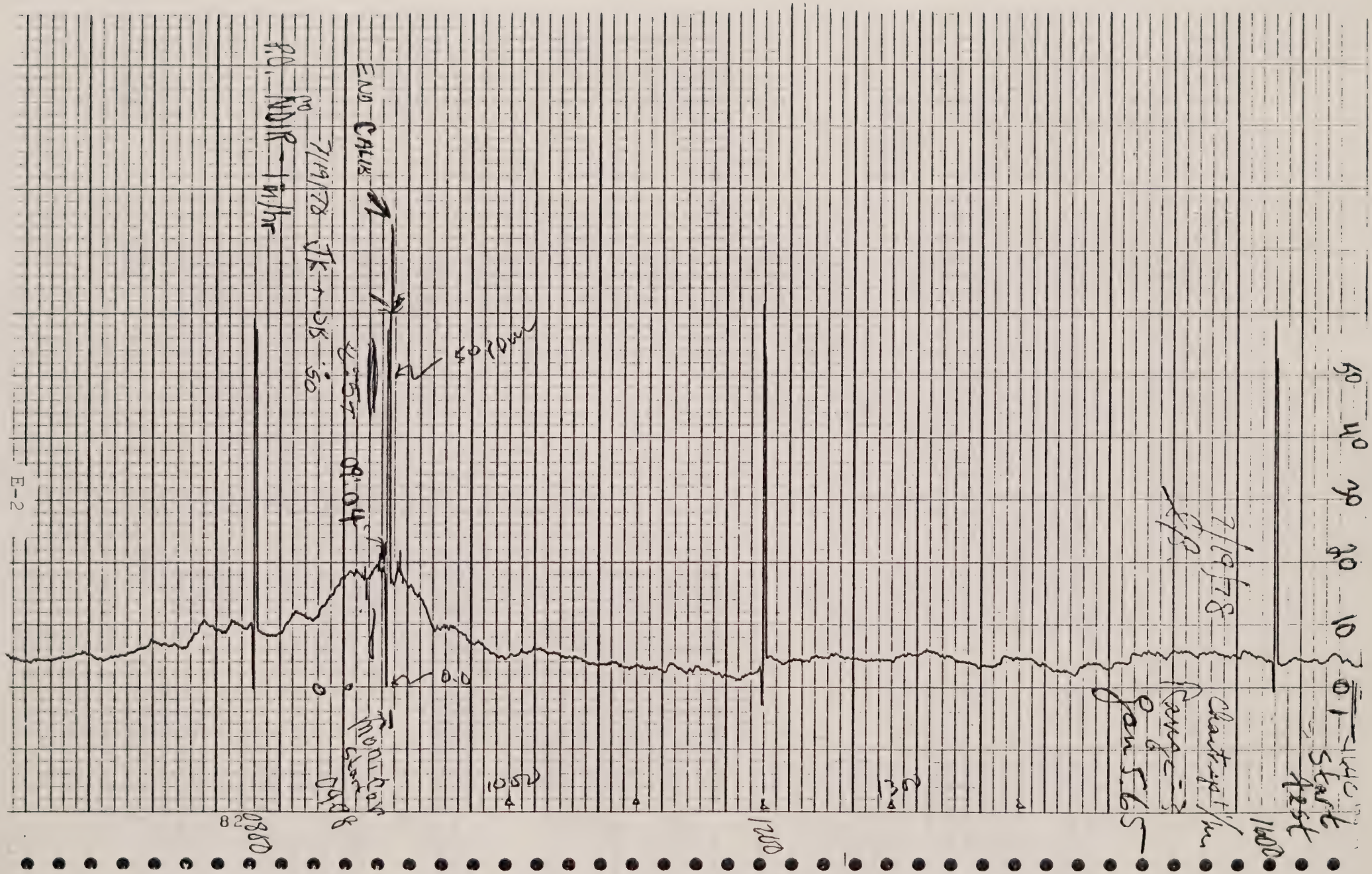
Dynamic Range:	16-143 dB
Resolution:	1 dB
Printout:	L% exceedance levels and L_{eq} for the analysis period selected
Analysis Period:	Period is keyboard selectable for time intervals of 10 sec.; 1 o 10 min.; 1, 10 or 24 hrs. At end period results are automatically printed, including time, and a new analysis is begun.

Mechanical

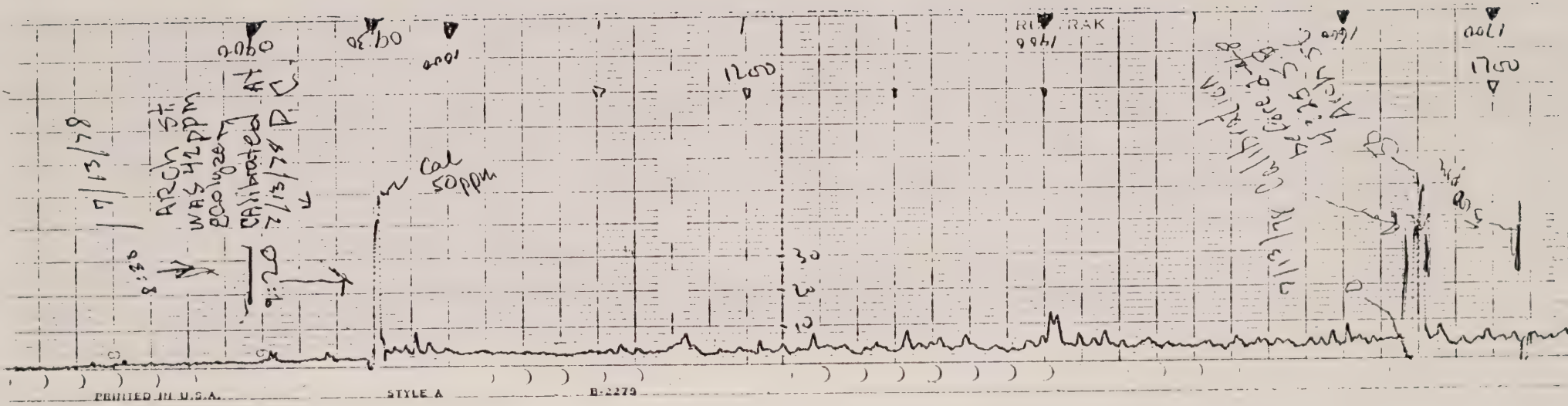
Dimensions:	16 x 16 x 10 inches (width x height x dep
Net Weight:	18 lbs without Battery Pack. 32 lbs with one BBN 800 Battery Pack.
Case:	Weather resistant. Anodized aluminum w handle and key lock.
Operating Temp:	- 10° C to + 50° C.

APPENDIX E

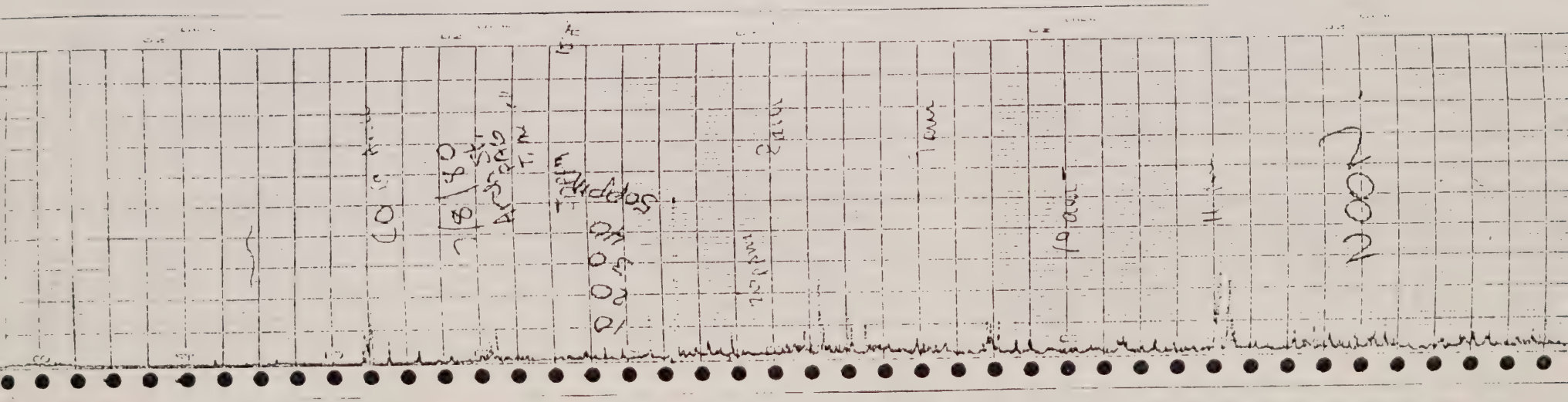
Examples of Continuous Strip Chart Records of the Various Parameters



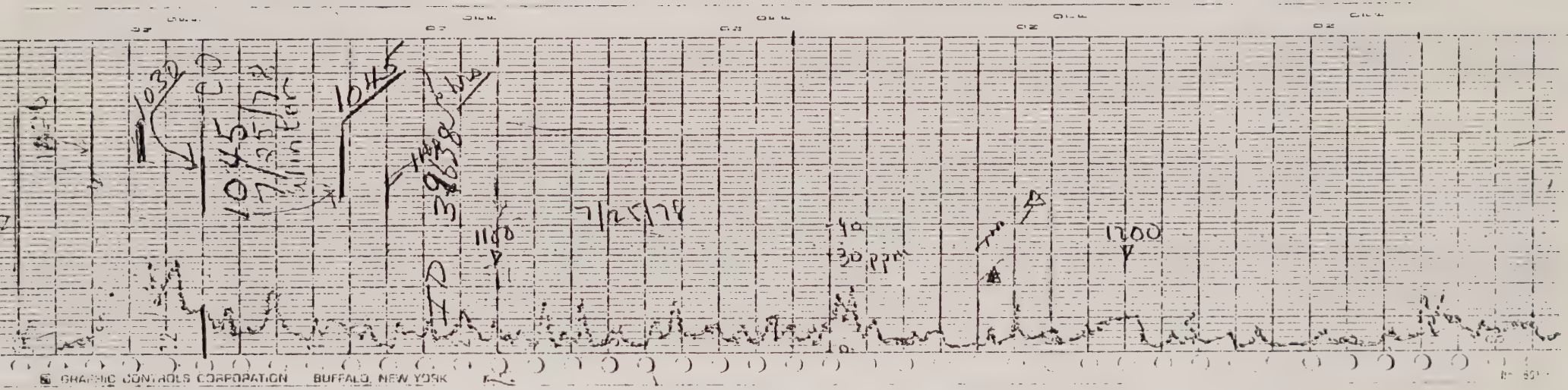
Measured Carbon Monoxide Levels at the Post Office Site using the NDIR Instrument (1978).



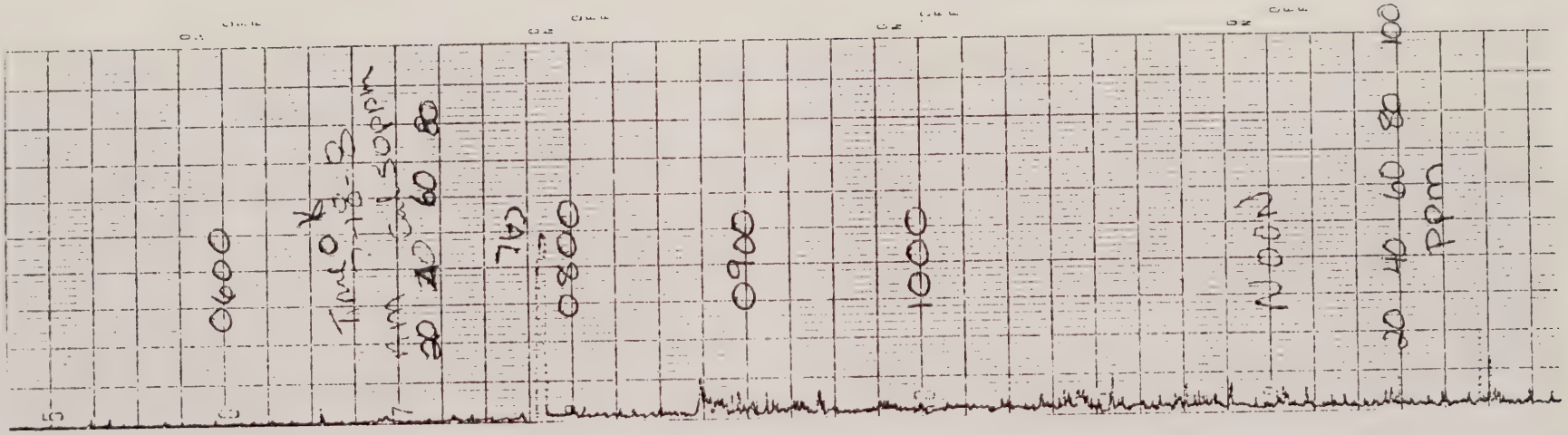
Carbon Monoxide Levels Taken at the Arch Street Site using an Ecolyzer Instrument (1978).



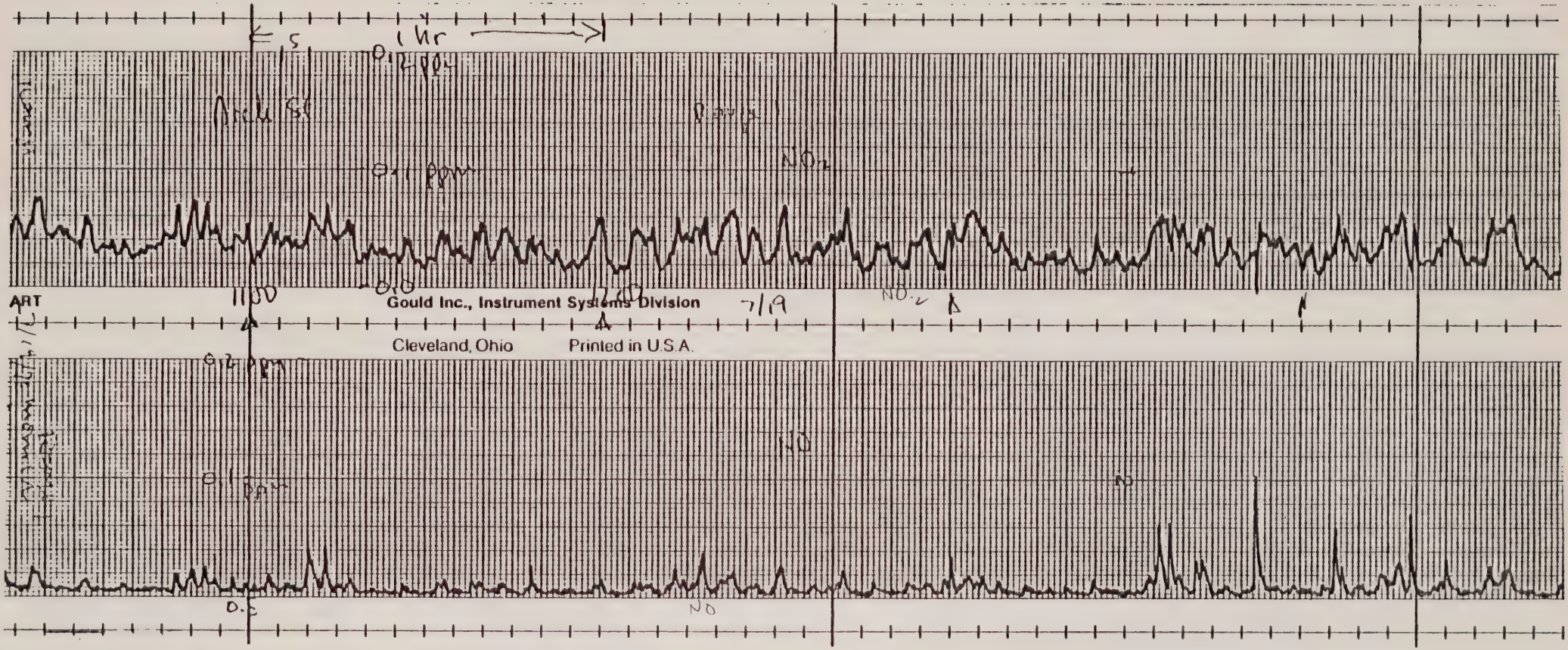
Measured CO Levels at the Arch St. Site using an Ecolyzer Instrument (1980).



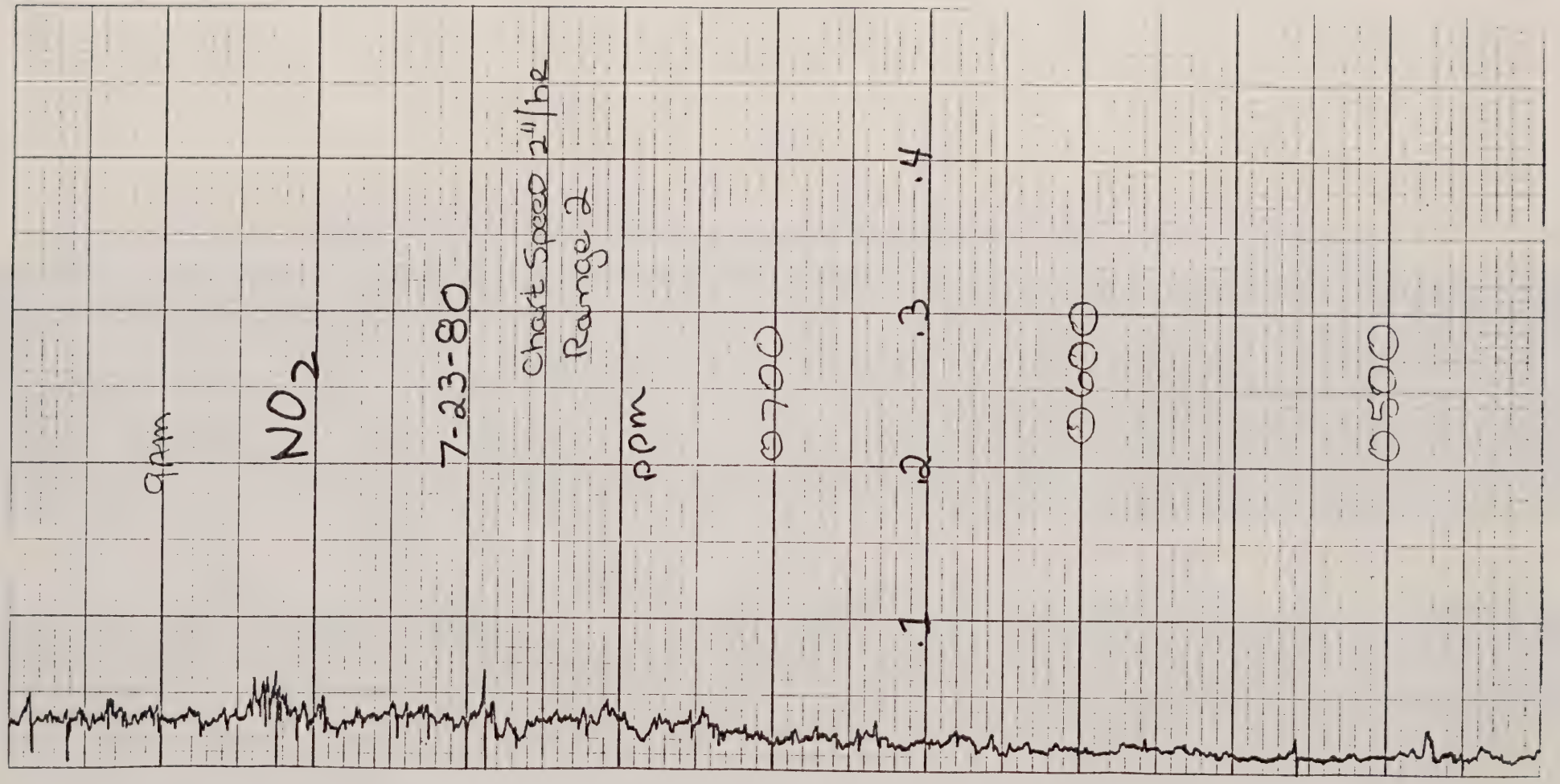
Carbon Monoxide Levels Measured at the Winter Street Site using an Ecolyzer Instrument (1978).



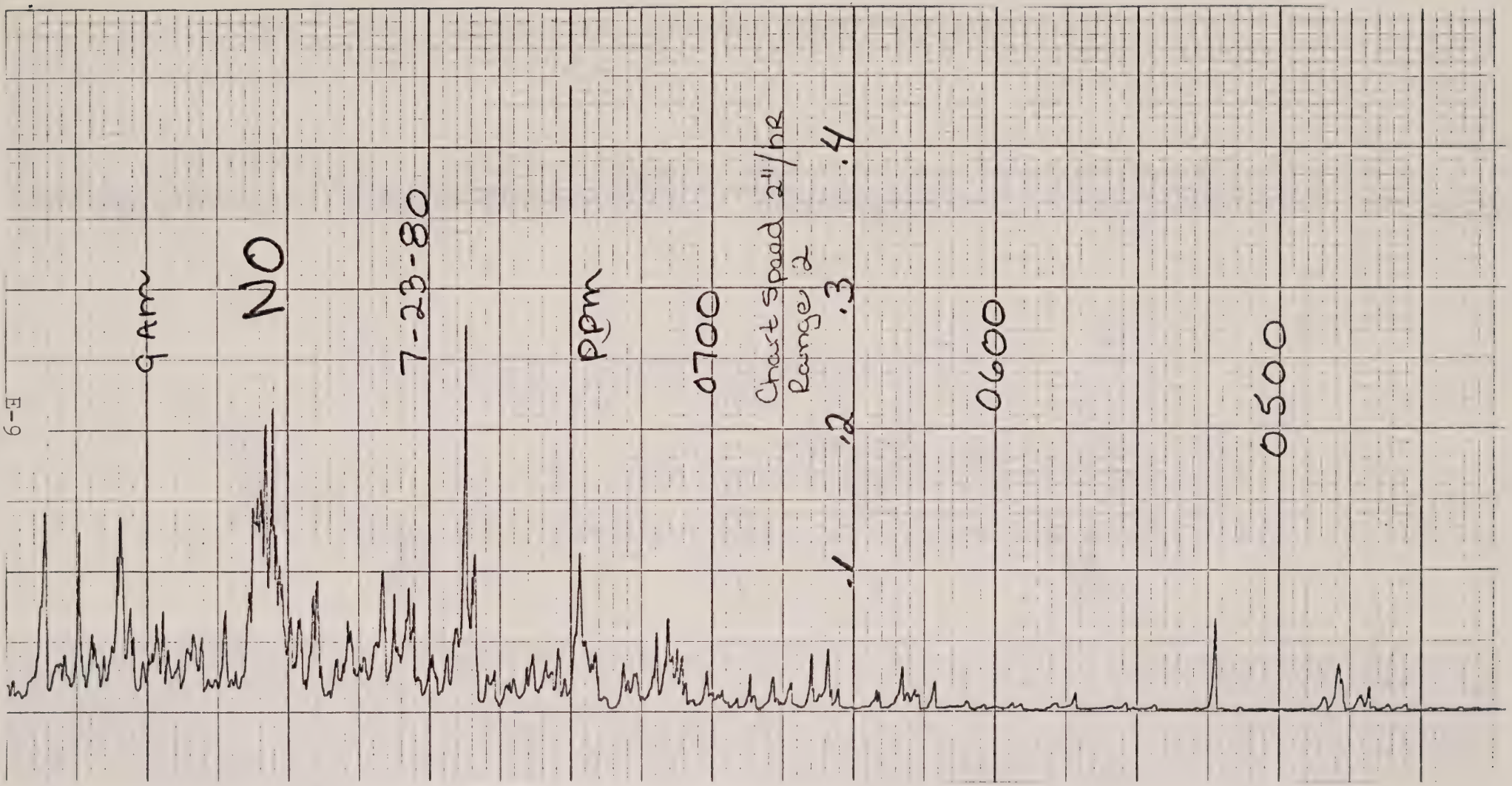
Carbon Monoxide Levels Measured at the Winter Street Site Using an Ecolyzer Instrument (1980).



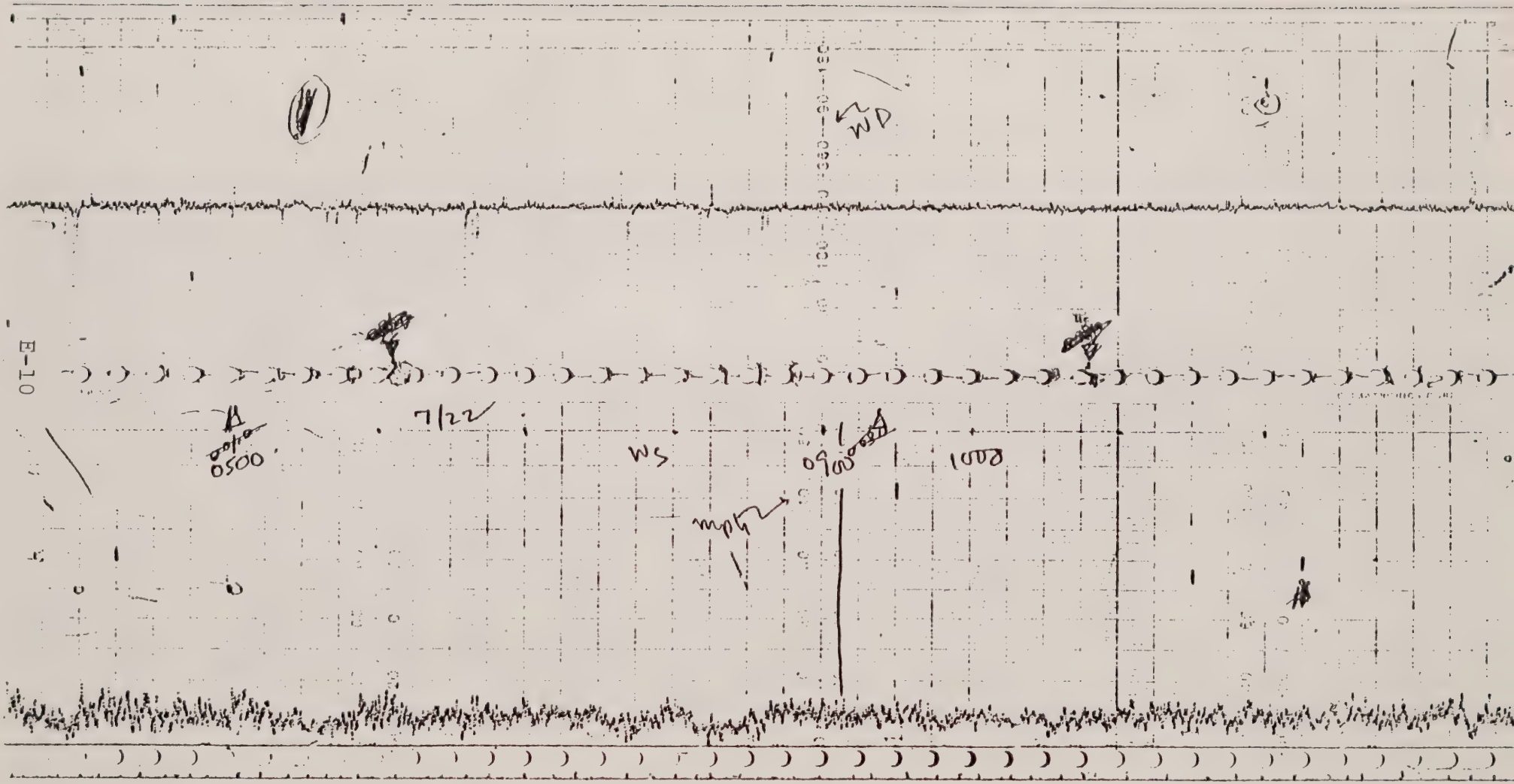
Strip Chart Record of Nitrogen Dioxide (NO_2) and Nitric Oxide (NO) Levels Measured at Arch Street (1978).



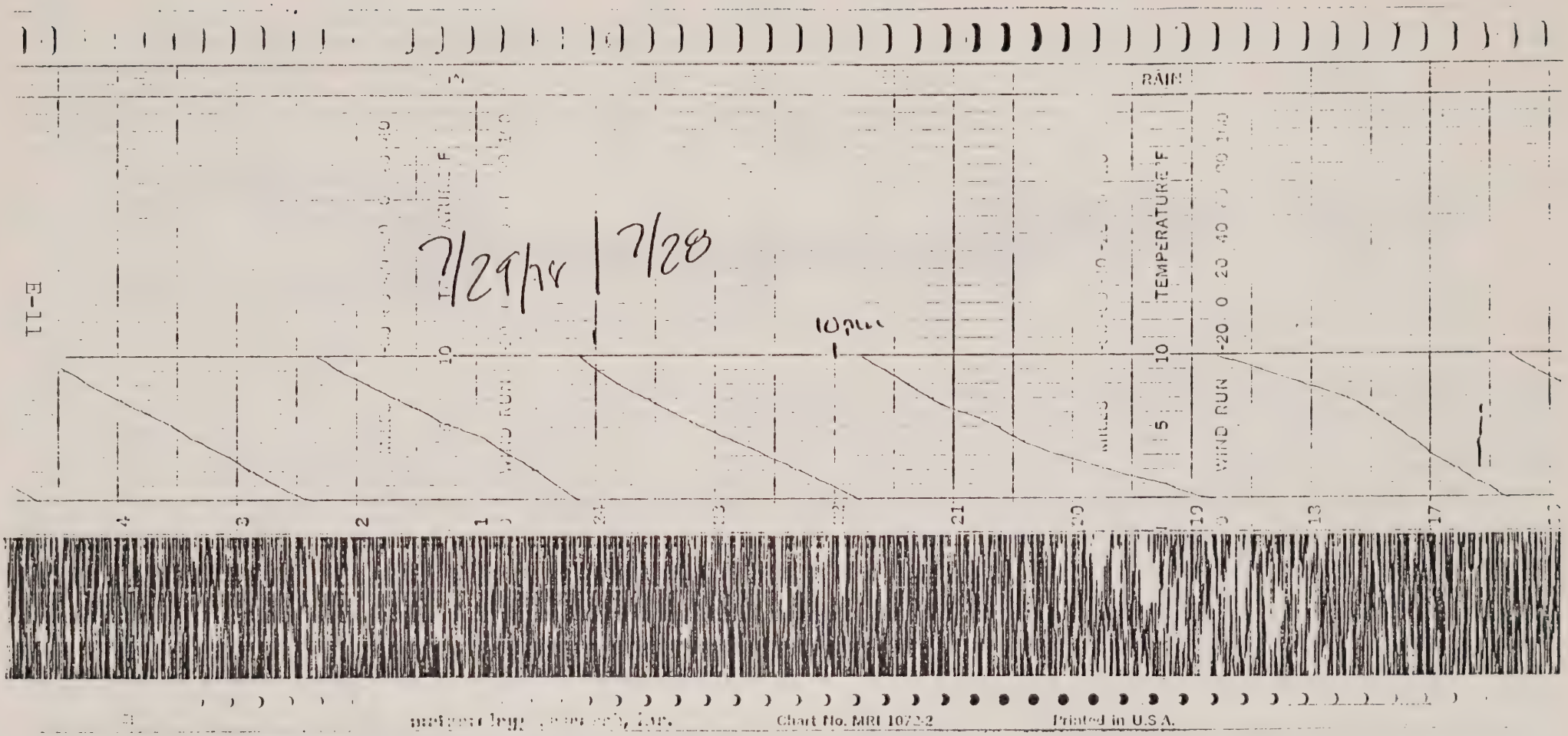
Strip Chart Record of Nitrogen Dioxide (NO_2) Levels Measured at Arch Street (1980).



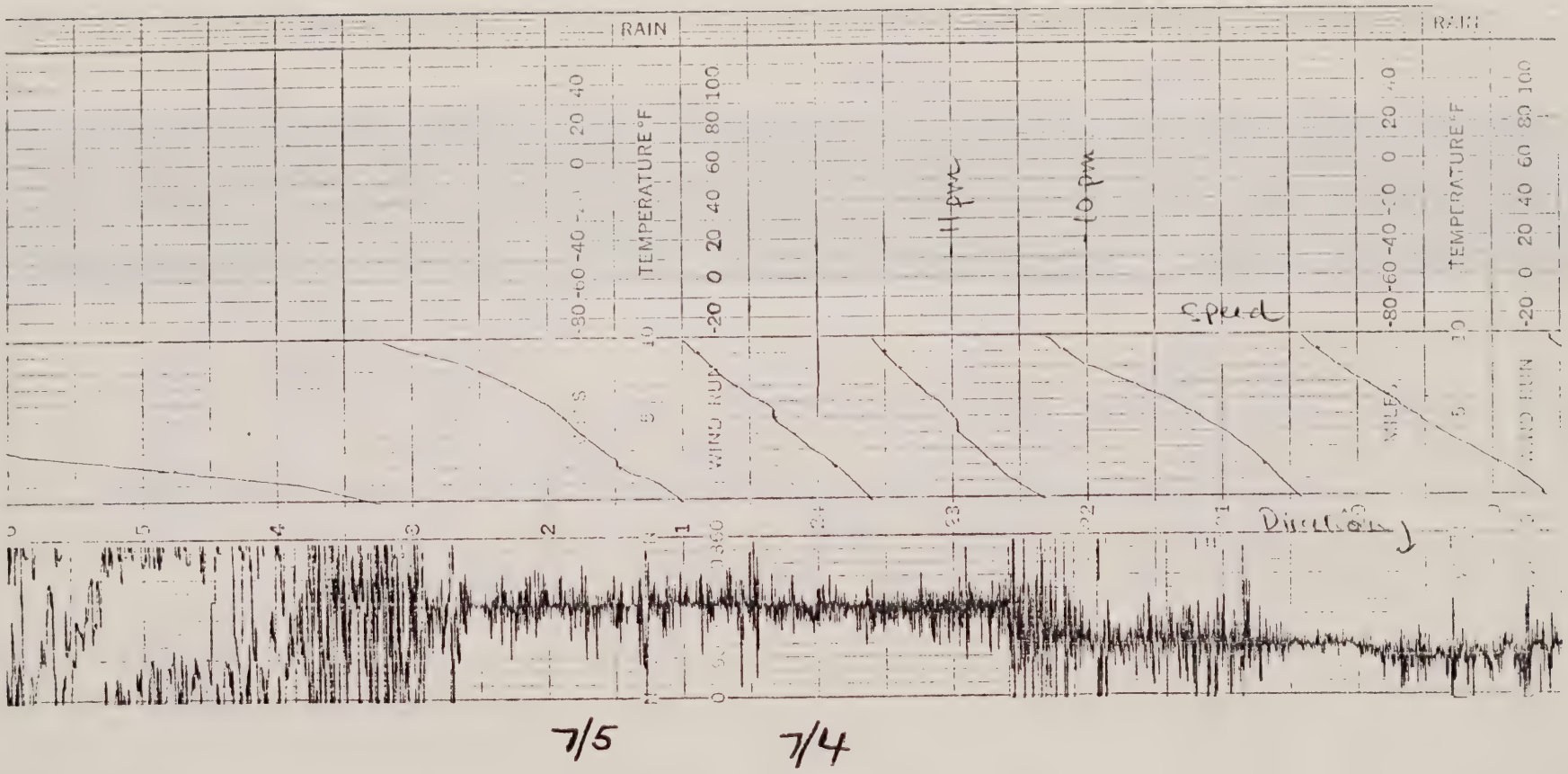
Strip Chart Record of Nitric Oxide (NO) Levels Measured at Arch Street (1980).



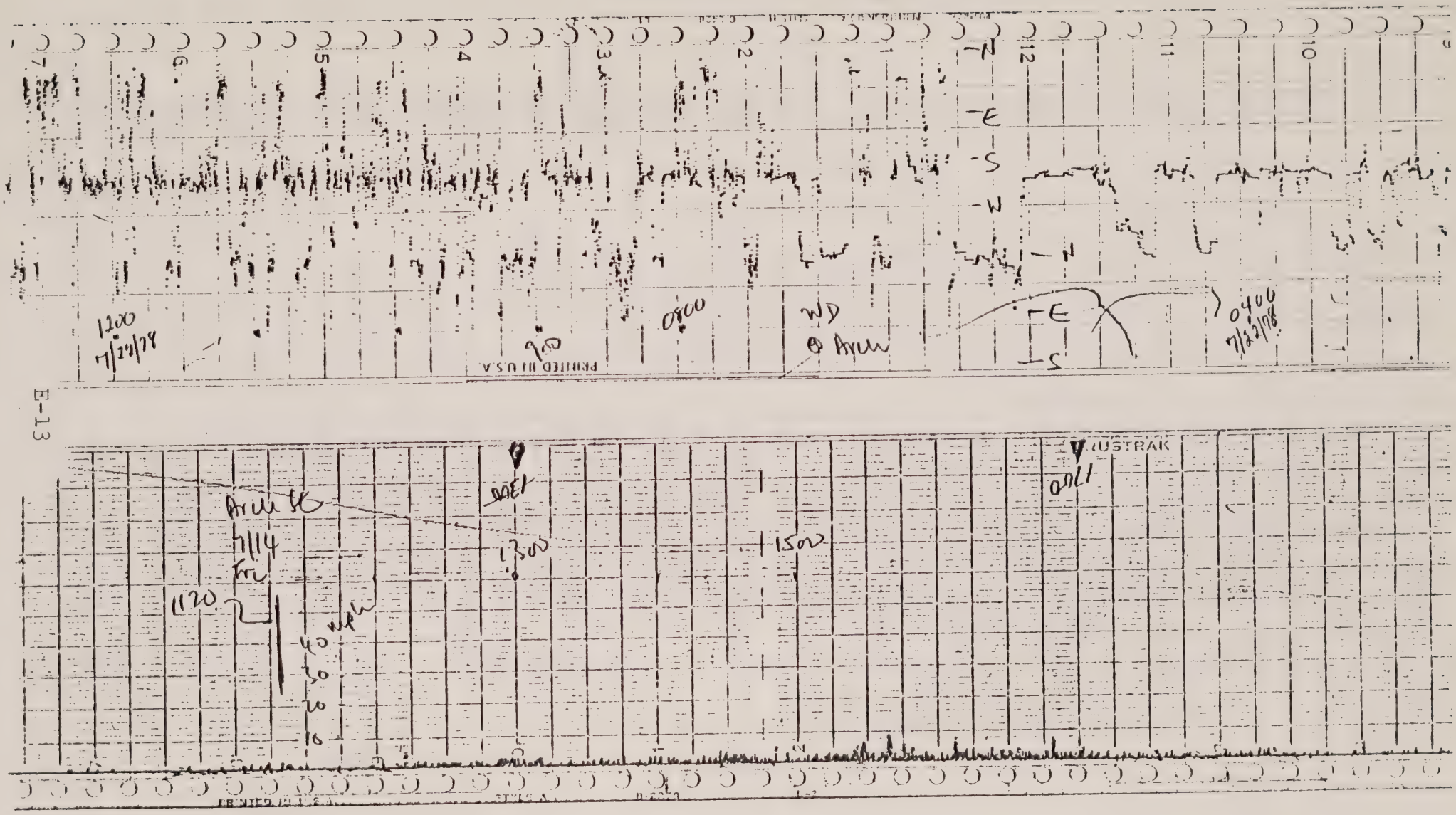
Wind Direction and Wind Speed Data Recorded at the Post Office Cafeteria Site using a Climatronics Electronic Weather Station (1978).



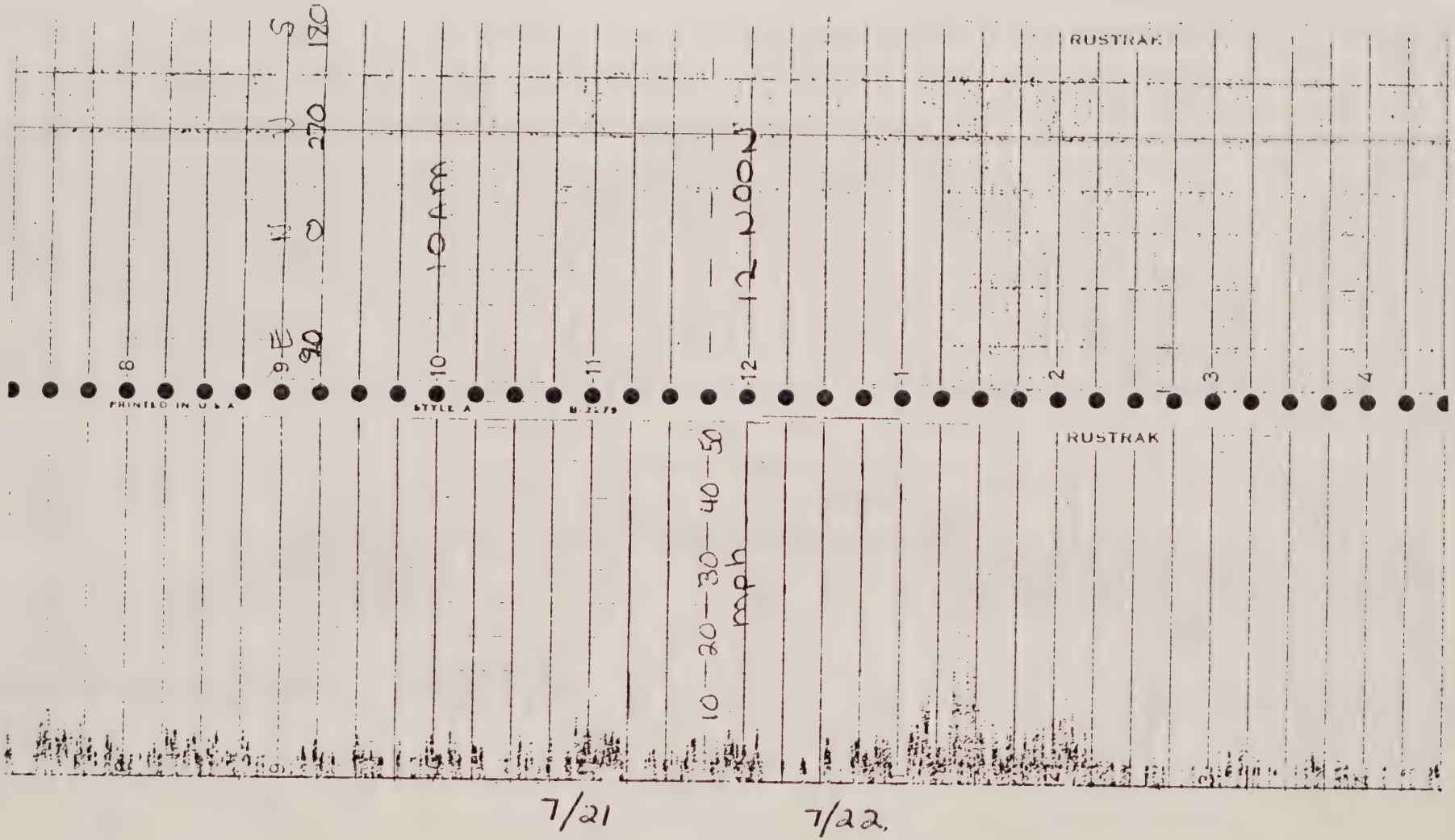
Wind Speed and Wind Direction Data Recorded at the Post Office Rooftop Site using a MRI Mechanical Weather Station (1978).



Wind Speed and Wind Direction Data Recorded at Post Office Rooftop Site Using MRI Mechanical Weather Station (1980).



Wind Direction and Wind Speed Data Taken at the Arch St. Site using a Texas Instrument Electronic Weather Station (1978).



Wind Speed and Wind Direction Data Recorded at Arch Street Site Using a Texas Instrument Electronic Weather Station (1980).

```
 60. 61. 63. 67. 75. 89.0%
050001   04 000 0667 F
050000   04 000 0667 H
 57. 57. 59. 63. 73. 82.0%
040001   04 000 0630 F
040000   04 000 0630 H
 54. 55. 56. 61. 76. 82.0%
030001   04 000 0635 F
030000   04 000 0635 H
 54. 55. 56. 61. 75. 83.0%
020001   04 000 0628 F
020000   04 000 0628 H
 55. 55. 57. 62. 69. 76.0%
010001   04 000 0598 F
010000   04 000 0598 H
 55. 56. 58. 63. 70. 82.0%
000003   04 000 0613 F
000002   04 000 0688 d
000001   04 000 0697 C
000000   04 000 0613 H
 56. 57. 59. 64. 76. 87.0%
230001   04 000 0645 F
230000   04 000 0645 H
 57. 59. 61. 65. 71. 87.0%
220001   04 000 0645 F
220000   04 000 0645 H
 57. 58. 60. 64. 71. 79.0%
210001   04 000 0630 F
210000   04 000 0630 H
 57. 58. 60. 64. 70. 80.0%
200001   04 000 0626 F
200000   04 000 0626 H
 58. 59. 61. 64. 72. 84.0%
190001   04 000 0643 F
190000   04 000 0643 H
 59. 60. 62. 66. 73. 83.0%
180001   04 000 0648 F
180000   04 000 0648 H
 59. 61. 63. 67. 74. 84.0%
170001   04 000 0656 F
170000   04 000 0656 H
 62. 63. 65. 68. 74. 80.0%
160001   04 000 0671 F
160000   04 000 0671 H
 63. 64. 66. 70. 76. 81.0%
```

Sound Level Data Taken at the Post Office Site using a BBN Model 614 Noise Monitor (1978).

```
060001   04 000 065.2  F
060000   04 000 065.2  H
 54. 55. 56. 57. 66. 74.0%
050001   04 000 057.9  F
050000   04 000 057.9  H
 54. 54. 55. 57. 71. 75.0%
040001   04 000 058.5  F
040000   04 000 058.5  H
 54. 54. 55. 58. 73. 83.0%
030001   04 000 061.3  F
030000   04 000 061.3  H
 54. 54. 56. 68. 79. 89.0%
020001   04 000 067.1  F
020000   04 000 067.1  H
 54. 54. 55. 57. 65. 71.0%
010001   04 000 056.8  F
010000   04 000 056.8  H
 54. 54. 55. 59. 68. 75.0%
000003   04 000 058.5  F
000002   04 000 072.0  d
000001   04 000 072.1  C
000000   04 000 058.5  H
 54. 55. 56. 60. 70. 78.0%
230001   04 000 059.8  F
230000   04 000 059.8  H
 55. 56. 57. 62. 70. 85.0%
220001   04 000 061.6  F
220000   04 000 061.6  H
 55. 56. 58. 62. 69. 81.0%
210001   04 000 060.9  F
210000   04 000 060.9  H
 57. 58. 60. 66. 74. 82.0%
200001   04 000 064.3  F
200000   04 000 064.3  H
 58. 58. 61. 66. 72. 80.0%
190001   04 000 063.9  F
190000   04 000 063.9  H
 60. 61. 63. 67. 72. 82.0%
180001   04 000 065.2  F
180000   04 000 065.2  H
 61. 62. 64. 68. 74. 83.0%
170001   04 000 066.3  F
170000   04 000 066.3  H
```

7/12/78

Sound Level Data Taken at the Arch St. Site using a BBN 614 Model Noise Monitor (1978).

```
 60. 62. 65. 73. 80. 88.0%
0800.02   04 000 070.3 F
0800.00   04 000 070.3 H
 57. 58. 61. 69. 78. 87.0%
0700.02   04 000 067.1 F
0700.00   04 000 067.1 H
 56. 57. 58. 66. 71. 82.0%
0600.02   04 000 063.0 F
0600.00   04 000 063.0 H
 54. 55. 57. 67. 82. 89.0%
0500.02   04 000 069.0 F
0500.00   04 000 069.0 H
 54. 55. 56. 57. 64. 78.0%
0400.01   04 000 057.5 F
0400.00   04 000 057.5 H
 54. 55. 56. 69. 81. 85.0%
0300.02   04 000 068.8 F
0300.00   04 000 068.8 H
 53. 55. 56. 60. 74. 82.0%
0200.02   04 000 061.8 F
0200.00   04 000 061.8 H
 54. 56. 56. 58. 67. 87.0%
0100.01   04 000 060.9 F   7/15
0100.00   04 000 060.9 H
-------------------------------
 56. 56. 57. 60. 73. 90.0%
0000.06   04 000 064.5 F   7/14
    .     00 01      . Z
0000.03   04 000 069.3 d
0000.02   04 000 067.6 d A
0000.00   04 000 064.5 H
 56. 56. 57. 60. 69. 91.0%
2300.02   04 000 061.8 F
2300.00   04 000 061.8 H
 55. 56. 57. 61. 70. 85.0%
2200.02   04 000 061.5 F
2200.00   04 000 061.5 H
 56. 56. 58. 62. 67. 78.0%
2100.01   04 000 060.1 F
2100.00   04 000 060.1 H
 57. 58. 59. 63. 70. 89.0%
```

Sound Level Data Taken at the Arch Street Site Using a BBN Model 614 Noise Monitor (1980).

```
070001   04 000 0748 F
070000   04 000 0748 H
 61. 61. 62. 74. 84. 95.0%
060001   04 000 0727 F
060000   04 000 0727 H
 61. 61. 62. 63. 70. 76.0%
050001   04 000 0631 F
050000   04 000 0631 H
 61. 61. 61. 63. 72. 87.0%
040001   04 000 0643 F
040000   04 000 0643 H
 61. 61. 61. 65. 75. 86.0%
030001   04 000 0656 F
030000   04 000 0656 H
 61. 61. 61. 64. 71. 84.0%
020001   04 000 0637 F
020000   04. 000 0637 H
 61. 61. 62. 67. 75. 83.0%
010001   04 000 0660 F
010000   04 000 0660 H
 61. 61. 62. 69. 81. 89.0%
000003   04 000 0690 F
000002   04 000 0742 d
000001   04 000 0750 C
000000   04 000 0690 H
 61. 62. 63. 69. 75. 86.0%
230001   04 000 0673 F
230000   04 000 0673 H
 61. 62. 64. 69. 76. 85.0%
220001   04 000 0675 F
220000   04 000 0675 H
 62. 62. 64. 69. 74. 83.0%
210001   04 000 0669 F
210000   04 000 0669 H
 62. 63. 64. 69. 74. 86.0%
200001   04 000 0675 F
200000   04 000 0675 H
 63. 64. 66. 70. 74. 78.0%
190001   04 000 0678 F
190000   04 000 0678 H
 66. 66. 68. 71. 81. 92.0%
180001   04 000 0714 F
180000   04 000 0714 H
175326            0693 A
175325            0676 A
```

Sound Level Data Taken at the Winter St. Site using a BBN Model 614 Noise Monitor (1978).

```
 56. 56. 57. 61. 66. 73.0%
1100.01   04  000  059.0  F
1100.00   04  000  059.0  H
 55. 55. 57. 66. 69. 77.0%
1000.02   04  000  061.5  F
1000.00   04  000  061.5  H
 54. 55. 57. 61. 67. 76.0%
0900.02   04  000  059.0  F
0900.00   04  000  059.0  H
 52. 52. 54. 60. 70. 74.0%
0800.01   04  000  058.3  F
0800.00   04  000  058.3  H
 51. 51. 54. 61. 68. 79.0%
0700.01   04  000  058.3  F
0700.00   04  000  058.3  H
 50. 50. 51. 55. 59. 77.0%
0600.02   04  000  054.3  F
0600.00   04  000  054.3  H
 50. 50. 50. 61. 77. 81.0%
0500.01   04  000  063.5  F
0500.00   04  000  063.5  H
 49. 50. 50. 52. 60. 74.0%
0400.02   04  000  052.6  F
0400.00   04  000  052.6  H
 49. 49. 50. 59. 71. 77.0%
0300.02   04  000  058.5  F
0300.00   04  000  058.5  H
 49. 49. 50. 51. 54. 66.0%
0200.02   04  000  051.0  F
0200.00   04  000  051.0  H
 49. 49. 50. 51. 55. 68.0%
0100.01   04  000  051.1  F   7/16
0100.00   04  000  051.1  H
 50. 50. 50. 52. 57. 65.0%   7/15
0000.05   04  000  051.7  F
    .     00  01       .  Z
0000.03   04  000  058.5  d
0000.02   04  000  056.8  dA
0000.00   04  000  051.7  H
 50. 50. 51. 53. 57. 63.0%
```

Sound Level Data Taken at the Winter Street Site Using a BBN Model 614 Noise Monitor (1980).

APPENDIX F

Tables of Digitized Data

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA. 02138

K.MENG CHANG
SENIOR TECHNICAL STAFF

FUN 27 AUG 1980
NDIR POST OFFICE 00 00000

LEAST SIGNIFICANT DIGIT = .1000

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
CO	78191																	61	76	34	39	60	37	25	21	71078	44	76	21	[illegible]
CO	78192	20	14	10	7	15	17	22	32	38	38	35	30	33	44	34	32	64	42	22	26	38	39	51	65	71178	32	65	7	779
CO	78193	33	27	27	16	14	20	31	47	45	45	54	49	58	55	62	87	140	62	94	83	90	39	77	70	71278	56	140	14	1334
CO	78194	34	32	25	14	25	16	28	64	86	64	46	39	53	48	49	47	58	54	95	85	84	49	40	34	71378	49	86	11	1001
CO	78195	23	20	18	21	6	10	17	43	75	40	31	51	54	52	42	51	50	48	31	22	30	23	25	24	71478	31	75	11	811
CO	78196	21	15	18	13	9	9	15	18	29	65	60	58	53	76	81	37	85	74	42	21	60	57	37	37	71578	46	85	11	1041
CO	78197	89	42	34	28	27	19	21	30	24	28	39	24	35	40	28	26	10	10	6	11	25	31	38	34	71678	23	89	6	679
CO	78198	32	14	11	9	8	20	24												111	84	140	121	110	143	71778	60	143	11	821
CO	78199	109	66	35	36	34	34	45	105	170	202	129	78	105	67	74	45	68	93	90	61	41	35	31	29	71878	74	202	29	1844
CO	78200	29	27	27	23	20	24	39	68	113	90	35	21	37	36	27	42	43	59	38	47	35	30	27	24	71978	40	113	20	961
CO	78201	24	15	12	14	14	20	23	47	81	63	47	47	40	46	42	46	49	51	40	33	40	4	18	11	72078	37	81	11	804
CO	78202	27	26	26	31	14	15	26	46	59	62	66	62	54	56	63	57	88	87	62	32	34	38	36	40	72178	40	98	11	1100
CO	78203	37	30	31	24	26	24	32	52	39	30	31	36	40	40	42	48	39	43	36	45	44	60	83	64	72278	41	83	24	[illegible]
CO	78204	71	46	50	34	18	16	21	26	17	17				20	17	20	17	22	27	27	34	35	42	19	72378	28	71	16	[illegible]
CO	78205	18	12	16	12	14	10	21	89	123	80	136	135	142	53	79	67	122	75	47	17	58	47	56		72478	62	142	10	1114
CO	78206	48	35	16	14	12	14	20	35	75	101	56	61	124	91	135	107	101	57	92	38	28	31	27	38	[illegible]	60	135	1	1143
CO	78207	24	20	23	22	21	30	65	69	120	88															[illegible]	48	120	20	881

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA. 02138

E.MENG CHNG
SENIOR TECHNICAL STAFF

RUN 27 AUG 1980
POST OFFICE CO (PPM)

LEAST SIGNIFICANT DIGIT = .1000

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
COP	78191																		37	19	18	23	9	5		71078	19	37	5	111
COP	78192										0	0	0	0	0	0	0	0	8	0	0	0	0	8		71178	1	8	0	16
COP	78193									0	16	31	33	32	22	43	54	50	50	11	31	36	38	37		71278	32	54	0	484
COP	78194									40	42	24	18	18	15	10	16	16	19	18	9	17	4	9		71378	18	42	4	275
COP	78195										8	0	12	23	21	18	7	10	4	9	2	0	0	0		71478	8	23	0	114
COP	78198											84	101	96	74	92	101	104	4	28	17	40	35	29	44	71778	61	104	4	849
COP	78199	28	14	7	1	0	0	0	32	52	70	75	50	56	48	46	41	45	49	53	45	34	16	9	14	71878	33	75	0	705
COP	78200	12	7	8	5	1	7												24	9	21	10	8	3	0	71978	9	24	0	115
COP	78201	0	0	1	0						38	51	62	39	31	36	47	30	18	8	5	12	0	0	4	72078	20	62	0	381
COP	78202	15									37	33	27	14	12	14	15	23	7	5	3	0	8	15	7	72178	15	37	0	235
COP	78203	5	0	0	0	0	0	4	6	6	7	0	6	4	5	0	0	0	0	0	0	15	5	4	9	72278	3	15	0	76
COP	78204	9	6	1	0	0	0	0	1	0	0															72378	2	9	0	17
COP	78206									15	5	11	27	47	69	57										72578	33	69	5	231

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA. 02138

K.MENG CHNG
SENIOR TECHNICAL STAFF

RUN 27 AUG 1980
ARCH STREET CO (PPM)

LEAST SIGNIFICANT DIGIT = .1000

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
COA	78191												18	42	45	44	66	64	111	76	59	66	23	10	10	71078	49	111	10	634
COA	78192	11	9	8	3	10	4	4	12	8	10	13	12	9	16	20	34	33	21	18	10	15	4	11	13	71178	13	34	3	308
COA	78193	12	16	15	3	5	11	22	17	36	37	32	16	20	20	20	39	20	35	17	23	23	28	36	35	71278	22	39	3	538
COA	78194	25	17	14	14	16	5	6	9	14	37	39	45	45	58	68	47	64	70	55	33	28	27	34	36	71378	34	70	5	806
COA	78195	17	11	14	5	8	8	34	44	64	37	57	54	53	56	58	70	41	38	27	17	13	15	13	12	71478	32	70	5	706
COA	78196	6	4	4	5	2	0	8	16	12	33	51	57	70	56	53	43	42	31	43	37	17	15	10	17	71578	26	70	0	632
COA	78197	16	15	11	8	10	8	11	10	16	13	19	29	36	17	8	14	24	11	27	8	8	5	9	17	71678	15	36	5	350
COA	78198	12	1	6	8	10	13	16	33	58	29	45	56	56	54	57	65	76	157	69	39	34	46	48	71	71778	41	157	1	1070
COA	78199	53	45	24	23	18	13	12	22	30	36	57	34	32	43	55	71	71	75	49	21	21	41	55	22	71878	40	75	12	761
COA	78200	22	12	14	10	6	9	20	21	67	60	41	40	37	41	49	45	61	69	50	63	46	28	25	20	71978	36	69	6	856
COA	78201	17	12	17	8	11	13	22	25	48	65	22	40	45	46		40	40	53	46	28	26	15	18	22	72078	30	65	8	679
COA	78202	12	11	9	11	4	7	15	14	36	55	88	78	49	52	42	52	49	63	40	31	19	26	19	19	72178	33	88	1	731
COA	78203	20	12	14	9	3	3	18	7	10	27	44	32	23	19	25	18	34	33	28	20	34	17	25	27	72278	31	44	3	510
COA	78204	36	35	19	19	12	9	12	18	25	20	36	40	51	44	31	23	40	37	63	34	26	21	13	6	72378	28	63	6	670
COA	78205	2	2	1	0	0	0	1	1	8	24	32	30	54	71	30	38	46	47	36	27	40	31	34	20	72478	24	71	0	494
COA	78206	17	10	9	5	6	6	17	45	21	36			40	54	64	58	76	63	49	22	13	9	17		72578	30	76	5	637
COA	78207								50	45	40															72678	45	50	40	135

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA 02138
HOWARD CROSSING STUDY

FRANK IACOVINO
SENIOR TECHNICAL STAFF

ARCH STREET CO [illegible]

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	HHMMYY	[illegible]	[illegible]	[illegible]
WR1	80189	11	12	15	18	12	0	15	21	36	38	71	7	18	25	18	30	21	26	20	16	30	9	30	26	[illegible]	17	7	[illegible]
WR1	80190	22	25	23	19	17	19	23	32	49	40	37	55	39	47	21	34	54	45	35	28	10	10	10	10	[illegible]	21	5	[illegible]
WR1	80191	5	5	5	5	5	5	5	3	5	10	18	20	19	16	16	16	25	22	16	18	42	30	20	4	[illegible]	15	47	[illegible]
WR1	80192	11	3	5	1	0	0	10	25	47	61	32	25	20	34	27	27	37	42	31	23	27	41	34	20	[illegible]	4	61	[illegible]
WR1	80193	12	13	19	24	10	14	16	27	41	47	40	36	35	33	36	40	37	35	23	27	25	15	22	20	[illegible]	27	41	[illegible]
WR1	80194	20	21	19	19	20	20	16	23	4	15	14	12	10	10	12	10	10	13	10	7	7	10	6	10	[illegible]	13	53	[illegible]
WR1	80195	18	32	18	6	13	19	19	15	17	1	4	7	9	3	6	3	12	23	29	33	18	31	23	10	[illegible]	15	23	[illegible]
WR1	80196	26	38	15	12	16	19	18	38	31	23	19	17	23	20	29	23	44	41	35	47	35	25	14	20	[illegible]	26	47	[illegible]
WR1	80197	17	17	21	13	3	14	22	5	33	38	48	50	25	23	20	20	30	20	20	18	15	12	7	5	[illegible]	21	50	[illegible]
WR1	80198	2	2	3	3	4	15	19	27	38	43	36	43	35	40	38	34	45	41	38	42	34	20	10	10	[illegible]	26	45	[illegible]
WR1	80199	10	10	8	13	13	17	26	36	53	30	22	20	30	35	41	37	39	53	38	33	43	20	20	10	[illegible]	28	53	[illegible]
WR1	80200	5	13	12	20	15	8	7	5	32	37	37	39	35	40	41	44	45	54	51	25	27	25	26	15	[illegible]	29	54	[illegible]
WR1	80201	8	6	8	12	16	6	7	13	18	20	20	26	10	26	31	23	33	32	26	16	0	0	19	16	[illegible]	17	53	[illegible]
WR1	80202	20	10	9	2	6	5	18	9	21	25	13	21	16	20	25	25	20	31	37	46	8	16	0	12	[illegible]	13	46	[illegible]
WR1	80203	10	4	13	15	25	23	25	29	55	64	23	46	36	4	23	22	43	49	51	41	31	25	14	21	[illegible]	31	64	[illegible]
WR1	80204	26	22	13	24	12	11	23	30	43	40	36	54	42	27	29	33	1	27	23	27	21	3	12	10	[illegible]	26	54	[illegible]
WR1	80205	10	14	18	22	26	30	34	38	42	46	30	20	48	42	35	37	41	47	45	36	23	18	19	28	[illegible]	18	54	[illegible]
WR1	80206	24	26	16	18	21	7	7	20	27	25	20	9	33	30	44										[illegible]	15	44	[illegible]

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA. 02138

K.MENG CHNG
SENIOR TECHNICAL STAFF

RUN 27 AUG 1980
WINTER STREET CO (PPM)

LEAST SIGNIFICANT DIGIT = .1000

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
COW	78193																	199	189	191	212	193	187	204		71293	196	212	187	1376
COW	78194											104						86	142	49	42	57	46	32		71393	70	142	32	558
COW	78195											89	142	162	91	133	143	136	174	91	46	54	30	46		71493	104	174	30	1347
COW	78198												106	81	86	131	175	144	263	191	131	92	54	86		71793	138	263	54	1540
COW	78199										89	81	227	159	134	104	123	108	217	45	25	44	66	47		71893	105	227	25	1469
COW	78200										71	89	112	95	185	164	107	100	107	89	98	60	48	54		71993	99	185	48	1379
COW	78201										96	113	203	149	120	119	99	107	111	59	55	55	56	43		72093	96	203	43	1350
COW	78202																106	127	103	80	30	41	51	51	60	72193	73	127	30	657
COW	78203	40	44																							72293	42	44	40	84
COW	78205										54	89	71	130	70	51	68	46								72493	72	130	46	579
COW	78206											91	68	124	134	141	132	43	49	29	38	39	24	37	31	72593	70	141	24	900
COW	78207	17	8	19	13	18	18	40	62	29	78	76	105	140	141	115	73									72693	60	141	8	952

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA 02138
[illegible] STUDY

FRANK IACOVINO
SENIOR TECHNICAL STAFF

RUN 15 SEP 1980
WINTER ST CO (PPM)
[illegible] SIGNIFICANT DIGIT = .1000

PID	YRMO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DG	HI	LO	[illegible]
												9	1	5	7	6	10	10	13	12	1	[illegible]	[illegible]	12	10	[illegible]	[illegible]	[illegible]	[illegible]	
WR2	80190	12	11	10	8	6	6	9	11	30	15	6	10	10	17	13	13	9	23	19	[illegible]	13	19	[illegible]	13	[illegible]	[illegible]	[illegible]	[illegible]	
WR2	80191	6	1	5	1	4	2	8	14	20	20	20	18	15	10	12	18	7	8	[illegible]	6	6	18	21	19	[illegible]	11	21	[illegible]	[illegible]
WR2	80192	12	8	10	10	10	8	12	11	16	15	13	9	8	9	15	13	14	14	12	[illegible]	11	13	13	14	[illegible]	12	14	[illegible]	[illegible]
WR2	80193	9	12	9	8	9	10	9	11	15	16	5	7	7	6	3	12	7	8	5	10	10	0	2	5	[illegible]	[illegible]	16	0	[illegible]
WR2	80194	3	3	2	0	0	0	0	2	0	0	0	0	2	5	0	0	5	8	[illegible]	[illegible]	0	0	0	[illegible]	[illegible]	[illegible]	8	0	[illegible]
WR2	80195	5	3	3	7	3	0	0	1	1																[illegible]	[illegible]	7	0	[illegible]
WC0	80197											25	36	37	23	29	20	20	19	24	20	26	27	27		[illegible]	[illegible]	37	19	[illegible]
WC0	80198							47	51	44	46	48	50	56	51	51	55	41	31	15	25	29	27	18	12	[illegible]	[illegible]	56	12	
WC0	80199	14	12	14	10	10	14	38	37	60	4	6	5	1	1	0	0	19	[illegible]	32	35	42	37	35	34	[illegible]	[illegible]	60	0	[illegible]
WC0	80200	21	21	21	20	21	14	17	29	24	32	32	35	32	27	34	43	30	33	33	22	27	29	27	28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WC0	80201	24	19	19	25	17	14	11	18	20	26	19	20	20	23	19	17									[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WC1	80202												11	15	10	10	11	8	13	15	15	16	16	13	17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WC1	80203	11	11	11	11	10	15	29	39	51	56	42	28	24	19	20	28	24	24	19	21	27	26	28	24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WC1	80204	20	13	14	12	10	8	13	26	59	32	19	17	22	21	22	22	24	13	7	9	2	6	8	7	[illegible]	12	[illegible]	[illegible]	[illegible]
WC1	80205	4	0	0	0	0	0	1	0	11	45	120	26	40	30	18	20	18	22	21	21	22	26	17	22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WC1	80206	15	13	15	13	13	11	13	16	15	16	15	17	48	19											[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA. 02138

K.MENG CHNG
SENIOR TECHNICAL STAFF

FRI 27 AUG 1980
ORCH STREET NO (PPID)
LARGE SIGNIFICANT DIFF

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
NO	78188												8	6	3	0	4	5	9	5	3	2	5	9	10	707?8	5	10	0	[illegible]
NO	78189	7	9	6	4	4	4	9	14	14	13	7	8	5	7	7	6	8	5	6	10	4	10	8	13	70[illegible]0	[illegible]	14	[illegible]	[illegible]
NO	78190	17	19	11	6	1	7	8	14	36	56	4	5	5	7	5	5	9	14	7	11	7	5	3	2	709?8	11	[illegible]	1	[illegible]
NO	78191	1	15	7	5	4	18	32	58	98	46	21	8				1	2	11							710?8	[illegible]	[illegible]	1	[illegible]
NO	78193										29	11	11	8	5	5	9	6	11	8	5	8	51	79	71	712?8	21	79	5	317
NO	78194	55	49	20	16	10	11	32	48	44	32	9	11	17	18	17	18	24	25	29	12	9	6	7	9	713?8	2	55	6	5?1
NO	78195	5	5	9	4	5	8	19	59	67	35	24	29	20	15	20	20	30	30	15	8	7	9	5	14	714?8	19	67	4	4?1
NO	78196	12	16	3	11	5	7	8	20	15	29	44	32	26	98	32	31	22	20	30	20	29	34	21	9	715?8	22	98	3	5?9
NO	78197	35	25	11	5	9	28	10	28	20	25	27	27	19	14	10	12	14	11	21	7	5	4	6	11	716?8	16	35	4	3?1
NO	78198	6	20	5	1	3	1	11	27	50	54	56	42	40	43	43	33	38	73	35	28	42	68	93	139	717?8	40	139	1	9??
NO	78199	76	59	45	36	26	16	17	50	83	61	33	25	13	17	22	28	32	24							718?8	37	83	13	6??
NO	78200										16	10	8	10	18	15	18	22	20	14	11	13	4	2	5	719?8	12	22	2	1??
NO	78201	6	9	14	6	1	2	17	18	21	60	12	15	6	6	11	20	14	18	5	5	9	6	10	9	720?8	16	71	5	3??
NO	78202	9	14	8	9	6	27	30	49	61	36	18	16	13	12	13	16	21	28	14	14	14	13	12	19	7?1?8	30	61	6	4??
NO	78203	16	12	10	9	8	14	13	7	8	12	7	5	9	8	6	8	7	7	7	7	5	7	6	12	722?8	9	16	5	2??
NO	78204	16	10	9	5	4	6	9	10	9	8	7	5	4	8	8	7	6	7	11	6	9	9	9	8	723?8	8	16	4	1??
NO	78205	7	7	9	5	4	8	11	22	46	27	28	25	24	41	30	29	34	35	25	40	34	59	57	31	7?4?8	27	59	4	6??
NO	78206	18	18	7	7	2	7	23	31	47	70	34	20	24	35	42	32	43	51	44	33	26	25	28	21	725?8	[illegible]	[illegible]	[illegible]	[illegible]
NO	78207	15	24	14	11	22	43	1??	115	121	68	48	43													726?8	[illegible]	[illegible]	[illegible]	[illegible]

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA 02138

FRANK IACOVINO
SENIOR TECHNICAL STAFF

RUN 12 SEP 1980
NITROGEN OXIDE (PPM)
Arch Street
LEAST SIGNIFICANT DIGIT = .0010

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	NHRDAY	Dn	HI	LO	TOTL
NO	80189										16	14	9	8	11	8	9	15	9	20	24	26	44	71	36	70780	21	71	0	300
NO	80190	36	30	13	15	20	22	66	104	151	75	22	37	28	41	40	44	83								70880	49	151	13	827
NO	80191										15	12	8	12	11	12				20	3	3	8	20	34	70980	13	34	3	158
NO	80192	11	10	5	4	3	6	25	95	113	116	69	63	60	53	72	50	79	58	31	18	18	31	41	21	71080	44	116	3	1057
NO	80193	2	2	0	0	2	3	28	65	57	41	40	19	17	14	30	43	27	30	19	0	0	0	14	12	71180	19	65	0	465
NO	80194	3	0	1	0	0	0	3	4	6	7	10	4	7	7	10	5	8	10	7	4	4	14	6	17	71280	6	17	0	137
NO	80195	47	48	27	11	3	4	6	4	0	0	2	3	1	0	0	1	2	9	7	1	6	22	45	20	71380	11	48	0	263
NO	80196	73	65	33	30	23	12	48	80	78	23	19	14	7	19	24	41	58	42	25	9	8	8	0	3	71480	31	80	0	742
NO	80197	2	3	13	1	8	7	23	46	54	38	17	13	10	11	10	17	25	22	10	4	1	3	4	1	71580	14	54	1	343
NO	80198	2	8	2	2	5	14	31	67	56	53	26	6	7	7	13	10	16	13	5	4	2	8	4	0	71680	15	67	0	361
NO	80199	2	14	1	3	5	9	18	48	61	36	20	15	17	10	12	25	21	31	6	2	3	4	2	5	71780	15	61	1	370
NO	80200	2	8	1	0	0	2	5	18	63	48	37	42	42	34	26	32	38								71880	23	63	0	398
NO	80201									26	14	11	10	7	6	10	11	13	19	16	6	3	2	0	1	71980	10	26	0	155
NO	80202	1	1	2	1	0	2	2	1	4	38	2	5	0	0	2	0	0	2	6	0	1	0	0	1	72080	3	38	0	71
NO	80203	0	0	0	2	2	5	11	57	59	57	22	13	8	6	10	4	23	22	11	2	3	9	7	2	72180	14	59	0	340
NO	80204	7	1	9	0	0	5	20	46									12	32	16	1	2	2	1	2	72280	10	46	0	143
NO	80205	2	1	0	2	1	2	9	39	52	46	36	13	25	17	17	25	36	46	17	11	7	19	4	7	72380	18	52	0	434
NO	80206	5	8	5	0	0	0	6	13	21	24	8	17	29	38	31	37	46	66	33	22	23	119	87	22	72480	28	119	0	660
NO	80207	16	6	6	0	0	2	6	18	40	19	10	7	3	6	11										72580	10	40	0	150

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA 02138

FRANK IACOVINO
SENIOR TECHNICAL STAFF

RUN 12 SEP 1990
PITTSBURGH OFFICE (PHIL)
Arch Street
LARGEST SIGNIFICANT DRIFT [illegible]

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
NO	80189										16	14	9	8	11	8	9	15	9	20	24	26	44	71	36	70790	21	71	8	320
NO	80190	36	30	13	15	20	22	66	104	151	75	22	37	28	41	40	44	83								70890	49	151	13	827
NO	80191										15	12	8	12	11	12				20	3	3	8	20	34	70990	13	34	3	159
NO	80192	11	10	5	4	3	6	25	35	113	116	69	68	60	53	72	50	79	58	31	18	18	31	41	21	71080	44	116	[illegible]	[illegible]
NO	80193	2	2	0	0	2	3	28	65	57	41	40	19	17	14	30	43	27	30	19	0	0	0	14	12	71180	19	65	0	391
NO	80194	3	0	1	0	0	0	3	4	6	7	10	4	7	7	10	5	8	10	7	4	4	14	6	17	71280	6	17	0	136
NO	80195	47	48	27	11	3	4	6	4	0	0	2	3	1	0	0	1	2	9	7	1	6	22	45	20	71380	11	48	0	[illegible]
NO	80196	73	65	33	30	23	12	48	80	78	23	19	14	7	19	24	41	58	42	25	9	8	8	0	3	71480	31	80	0	742
NO	80197	2	3	13	1	8	7	23	46	54	38	17	13	10	11	10	17	25	22	10	4	1	3	4	1	71580	14	54	1	343
NO	80198	2	8	2	2	5	14	31	67	96	53	26	6	7	7	13	10	16	13	5	4	2	8	4	0	71680	15	67	0	383
NO	80199	2	14	1	3	5	9	18	48	61	36	20	15	17	10	12	25	21	31	6	2	3	4	2	5	71780	15	61	1	320
NO	80200	2	8	1	0	0	2	5	18	63	48	37	42	42	34	26	32	38								71880	23	63	0	308
NO	80201									96	14	11	10	7	6	10	11	13	19	16	6	3	3	0	1	[illegible]	16	29	[illegible]	[illegible]
NO	80202	1	1	2	1	0	2	2	1	4	38	2	5	0	0	2	0	0	2	6	0	1	0	0	1	72080	3	38	0	71
NO	80203	0	0	0	2	2	5	11	57	59	57	22	13	8	6	10	4	23	22	11	2	3	9	7	2	72180	14	59	0	310
NO	80204	7	1	9	0	0	5	20	46									12	32	16	1	2	2	1	2	72280	10	46	0	155
NO	80205	2	1	0	2	1	2	9	39	52	46	36	13	25	17	17	25	36	46	17	11	7	19	4	7	72380	18	52	0	454
NO	80206	5	8	5	0	0	0	6	13	21	24	8	17	29	38	31	37	46	66	33	22	23	119	87	22	72480	20	119	0	[illegible]
NO	80207	16	6	6	0	0	2	6	18	40	19	10	7	3	6	11										[illegible]	10	91	[illegible]	1[illegible]

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA. 02138

K.MENG CHNG
SENIOR TECHNICAL STAFF

RUN 27 AUG 1980
ARCH STREET NO2 (PPM)

LEAST SIGNIFICANT DIGIT = .005

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
NO2	78188												54	39	33	33	41	37	52	37	34	30	40	37	29	70778	28	54	29	496
NO2	78189	27	25	23	15	13	16	24	28	31	38	30	28	22	25	27	24	28	29	29	26	29	30	24	23	70878	26	38	13	614
NO2	78190	24	24	24	18	17	15	11	15	20	17	20	32	23	18	15	16	23	27	28	22	20	17	17	18	70978	20	28	11	471
NO2	78191	16	20	18	21	17	20	24	26	35	43	38	30				17	16	26	16	20	23	17			71078	23	43	16	443
NO2	78193										36	30	33	27	25	26	20	14	18	17	22	31	35	28	26	71278	26	36	14	388
NO2	78194	28	28	29	31	34	32	30	35	49	55	40	27	20	23	25	27	37	38	52	42	48	45	46	34	71378	36	55	20	856
NO2	78195	23	22	20	14	13	16	24	34	34	35	30	34	36	29	37	40	38	42	35	25	25	21	20	27	71478	28	42	13	674
NO2	78196	28	28	27	18	15	18	27	30	24	29	27	27	26	27	31	33	38	33	30	35	36	37	33	24	71578	28	38	15	601
NO2	78197	35	32	31	27	24	24	22	25	23	28	32	32	36	32	32	31	34	34	34	21	29	29	28	34	71678	30	36	21	709
NO2	78198	23	18	17	15	13	17	29	31	31	26	24	26	29	30	35	44	39	31	33	32	33	37	37	28	71778	28	44	13	609
NO2	78199	34	34	30	27	25	25	24	25	28	37	42	36	50	56	43	47	54	42							71878	37	56	24	659
NO2	78200										64	46	36	39	34	39	47	48	44	50	59	60	53	41	33	71978	46	64	33	673
NO2	78201	35	26	32	18	14	22	32	47	63	64	50	49	42	39	35	48	52	66	49	42	38	29	37	31	72078	40	66	14	960
NO2	78202	28	28	24	27	28	36	40	56	66	76	76	63	47	42	49	52	63	68	55	62	49	57	52	56	72178	50	76	24	1200
NO2	78203	50	38	37	29	25	39	41	41	44	43	27	27	27	23	24	23	25	27	33	32	40	53	62	61	72278	36	62	23	875
NO2	78204	67	51	45	36	32	24	24	27	26	26	25	28	25	22	16	22	23	26	29	30	33	28	25	15	72378	29	67	15	705
NO2	78205	20	20	19	13	11	13	17	22	30	26	31	25	28	38	31	29	33	37	39	46	46	52	50	45	72478	30	52	11	721
NO2	78206	38	28	23	19	20	24	32	38	47	60	51	48	64	80	73	68	64	62	42	38	38	38	42	35	72578	45	80	19	1072
NO2	78207	33	31	29	34	37	41	43	49	58	53	44	51													72678	42	58	29	503

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA 02138

FRANK IACOVINO
SENIOR TECHNICAL STAFF

RUN 12 SEP 1980
NITROGEN DIOXIDE (PPM)
Arco St. NO2
LEAST SIGNIFICANT DIGIT = .001

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDYY	DA	HI	LO	TIME
NO2	80189										20	17	14	12	14	13	14	17	13	21	33	39	47	52	46	70780	25	52	12	372
NO2	80190	41	29	27	28	26	23	23	32	30	34	40	58	57	56	49	45	48	53	48	39	38	40	42	35	70880	39	58	23	941
NO2	80191	29	33	31	30	22	20	27	34	32	28	23	17	21	21	27	19			25	22	30	35	37	40	70980	27	40	17	603
NO2	80192	37	31	19	20	20	20	28	30	38	40	39	36	35	36	42	34	37	43	42	33	11	46	58	50	71080	30	58	11	1111
NO2	80193	45	19	13	9	11	13	37	55	54	50	52	30	30	31	30	52	47	50	37	30	29	24	54	48	71180	30	58	9	1024
NO2	80194	26	25	22	22	11	9	11	7	5	7	8	7	10	10	12	8	11	13	12	14	17	24	21	24	71280	14	26	5	556
NO2	80195	22	20	21	14	17	11	10	6	3	1	3	9	7	5	6	8	13	32	34	22	43	48	42	33	71380	13	48	1	630
NO2	80196	29	29	28	23	22	22	23	33		28	22	21	18	26	32	44	48	55	57	36	36	31	38	33	71480	13	57	13	729
NO2	80197	22	21	27	14	22	21	36	51	54	56	48	43	38	42	43	51	65	58	40	37	32	25	24	21	71580	37	65	14	891
NO2	80198	16	18	12	12	16	25	35	51	55	59	48	41	40	39	35	31	48	53	38	33	44	48	31	31	71680	36	59	12	859
NO2	80199	34	34	18	15	14	20	29	45	51	47	46	43	47	41	36	41	44	63	42	32	34	32	40	41	71780	37	63	14	889
NO2	80200	35	25	23	16	19	18	19	26	36	36	35	38	32	31	33	43	41								71880	30	43	16	507
NO2	80201									38	37	33	33	29	28	38	36	35	35	37	39	37	29	30	26	71980	34	39	26	540
NO2	80202	23	22	16	18	15	10	12	17	21	33	25	21	18	18	17	15	16	28	32	32	25	26	28	21	72080	21	33	10	509
NO2	80203	19	22	21	24	20	29	32	56	62	64	64	50	47	36	37	31	48	50	46	30	35	44	39	24	72180	39	64	19	930
NO2	80204	20	11	18	11	14	23	28	39									50	55	49	29	24	24	21	21	72280	27	55	11	437
NO2	80205	12	13	13	10	12	13	18	29	35	32	32	33	36	33	38	42	41	43	38	30	24	21	26	31	72380	27	41	10	650
NO2	80206	30	26	25	20	16	10	15	16	21	20	13	26	33	40	45	41	42	45	41	17	21	27	40	30	72480	1	57	10	760
NO2	80207	26	24	25	22	16	15	22	28	37	34	27	20	16	21	22	23									72580	24	37	15	333

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA. 02138

L.MENG CHNG
SENIOR TECHNICAL STAFF

RUN 27 AUG 1980
POST OFFICE ROOF WIND RUN (MPH)

LEAST SIGNIFICANT DIGIT = .1000

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
WSP	78191																		22	73	63	64	75	78	69	71078	63	78	22	444
WSP	78192	53	57	58	69	61	62	40	44	53	53	66	67	66	66	73	61	79	61	52	44	41	39	53	29	71178	56	79	29	1347
WSP	78193	25	22	30	35	39	38	37	39	44	37	19	39	50	45	51	50	55	55	58	42	23	18	21	27	71278	37	58	18	899
WSP	78194	30	38	33	43	45	42	40	36	25	21	34	38	61	56	60	53	65	78	103	96	84	76	83	69	71378	55	103	21	1309
WSP	78195	79	71	88	87	82	65	59	66	65	69	64	80	77	64	64	65	76	72	60	72	63	69	71	78	71478	71	88	59	1706
WSP	78196	93	96	75	72	48	63	58	58	55	32	67	71	67	34	25	23	27	34	24	10	14	29	28	15	71578	47	96	10	1118
WSP	78197	13	11	29	20	25	13	14	10	11	12	12	15	20	31	38	36	36	40	36	41	35	28	24	18	71678	24	41	10	568
WSP	78198	17	26	23	31	23	31	50	41	47	46	46	48	42	57	40	36	32	24	41	24	16	19	9	14	71778	33	57	9	783
WSP	78199	16	21	24	28	41	51	44	30	36	26	23	18	23	29	34	28	28	31	29	24	38	59	59	64	71878	34	64	16	804
WSP	78200	66	46	31	31	29	27	23	27	21	31	45	63	53	54	56	49	55	47	49	42	70	66	64	49	71978	46	70	21	1094

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA. 02138

K.MENG CHNG
SENIOR TECHNICAL STAFF

RUN 27 AUG 1980
POST OFFICE ROOF WIND SPEED (MPH)

LEAST SIGNIFICANT DIGIT = .1000

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
WSR	78202										46	46	48	49	56	51	53	58	51	66	63	58	61	56	59	72178	55	66	46	821
WSR	78203	54	53	56	52	49	45	45	39	57	48	53	49	51	60	59	38	50	42	54	54	54	53	52	42	72278	50	60	38	1209
WSR	78204	39	37	36	34	28	42	40	43	55	53	50	63	67	86	93	109	104	105	108	101	87	77	73	86	72378	67	109	28	1616
WSP	78205	56	58	49	38	16	17	14	21	20	20	15	23	32	31	73	53	58	54	52	58	52	41	36	30	72478	33	73	14	917
WSP	78206	52	41	52	48	50	49	48	32	29	30															72578	43	52	29	431

BOLT BERANEK AND NEWMAN INC.,
50 MOULTON STREET FRANK IACOVINO
CAMBRIDGE, MA 02138 SENIOR TECHNICAL STAFF

RUN 29 NOV 1984
WIND SPEED (MILES/HR)
Post Office Roof
LEAST SIGNIFICANT DIGIT = .1000

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
WR	80184													70	109	103	83	110	136	110	114	131	109	123	124	120880	110	136	70	1400
WR	80185	75	45	38	40	37	30	24	20	35	74	97	96	86	95	89	90	116	83	73	52	76	92	87	76	120880	68	116	20	1677
WR	80186	70	48	43	48	58	55	57	42	30	42	55	41	62	64	63	64	74	83	60	50	68	40	69	86	120880	57	83	30	1374
WR	80187	74	61	33	20	9	10	9	14	23	38	53	47	48	81	105	105	123	101	90	70	98	115	134	90	120880	64	134	9	1527
WR	80188	89	69	71	71	63	78	75	97	97	114	115	113	106	107	96	106	107	83	89	100	53	53	77	74	120880	80	115	53	1700
WR	80189	58	73	68	60	78	79	80	54	49	65	62	62	72	66	76	60	61	54	45	42	30	26	33	44	120780	58	80	26	1411
WR	80190	52	38	41	50	39	71	84	103	79	98	106	119	124	65	85	140	154	88	68	78	58	60	71	66	120880	81	154	38	1953
WR	80191	60	55	63	59	65	84	79	65	48	46	59	60	53	38	58	58	62	60	52	41	29	28	41	41	120980	55	84	28	1213
WR	80192	72	47	51	86	104	93	78	68	47	89	92	77	79	95	99	138	110	109	94	80	54	33	78	99	121080	82	138	33	1972
WR	80193	88	68	74	96	92	99	65	102	78	67	95	97	104	90	90	119	139	125	120	97	115	68	64	83	121180	96	139	64	2000
WR	80194	105	95	46	45	61	81	55	56	58	56	72	86	69	71	83	80	106	73	64	52	54	52	46	34	121080	64	106	21	1596
WR	80195	23	36	46	59	62	57	67	76	81	77	93	46	61	63	66	56	64	65	49	29	17	19	29	31	121080	51	81	17	1201
WR	80196	17	23	25	46	54	71	63	43	46	47	39	48	50	66	67	71	85	48	38	63	84	131	103	129	121080	61	131	17	1411
WR	80197	116	126	111	117	103	173	157	137	107	106	134	148	160	145	153	103	180	132	150	102	105	150	157	147	121080	146	180	103	3083
WR	80198	152	149	106	124	136	137	116	93	72	83	63	64	69	77	90	82	76	62	67	111	85	76	54	69	121080	94	152	54	2564
WR	80199	74	94	156	136	67	61	50	47	52	91	81	133	90	87	60	99	123	152	152	107	103	82	54	66	121080	96	156	47	2333
WR	80200	49	30	35	42	36	29	35	42	52	56	69	41	96	73	77	65	68	54	38	47	45	89	103	128	121080	57	128	29	1364
WR	80201	118	112	122	101	76	66	107	66	63	82	88	100	103	91	117	103	101	117	116	65	84	99	104	93	121080	96	122	63	2340
WR	80202	98	100	113	110	114	126	100	88	78	80	93	85	81	84	84	95	85	73	98	73	66	84	71	111	121080	87	126	63	2309
WR	80203	56	46	44	64	65	46	46	42	37	30	25	63	98	100	90	56	51	81	80	82	60	102	113	110	122100	63	113	25	1837
WR	80204	108	128	113	66	41	53	79	69	48	62	74	83	107	147	123	116	99	150	111	143	143	146	148	145	122100	150	150	41	2611
WR	80205	157	81	81	66	70	112	98	80	92	81	63	53	72	60	63	68	104	121	110	107	116	91	121	70	122380	80	157	53	2115
WR	80206	73	51	51	45	50	80	79	57	60	52	55	65	50												120180	80	180	45	1768

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA. 02138

K.MENG CHNG
SENIOR TECHNICAL STAFF

RUN 27 AUG 1980
POST OFFICE MODE WIND DIRECTION (DEG)
LEAST SIGNIFICANT DIGIT 1.0000

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
WDP	78191																		196	246	245	240	205	240	207	71078	248	296	196	6666
WDP	78192	194	198	195	202	194	52	284	273	252	240	166	221	198	205	99	117	87	271	258	210	206	176	41	74	71178	184	284	41	4413
WDP	78193	208	158	153	146	141	150	145	215	224	290	236	244	241	234	239	238	262	258	265	220	252	186	170	219	71278	212	290	141	5094
WDP	78194	177	222	163	208	189	207	202	179	188	208	197	171	195	188	178	194	190	211	202	204	216	221	224	222	71378	198	224	163	4696
WDP	78195	221	208	204	213	203	209	212	184	207	198	192	206	186	162	184	205	199	186	166	197	188	193	196	194	71478	196	221	162	4718
WDP	78196	201	195	199	204	206	202	208	204	210	195	219	229	210	182	170	202	212	194	217	241	237	114	200	173	71578	201	241	114	4854
WDP	78197	109	237	207	274	12	72	229	161	261	215	252	260	235	242	227	238	252	251	245	233	247	261	198	213	71678	214	274	12	5131
WDP	78198	159	206	245	204	157	51	40	41	45	46	35	32	47	52	41	41	160	159	195	207	215	210	210	166	71778	124	245	32	2964
WDP	78199	150	164	166	176	270	290	267	129	83	72	79	201	269	252	246	251	209	196	198	208	203	223	241	251	71878	202	290	72	4854
WDP	78200	243	230	139	177	178	232	146	162	200	178	151	155	171	171	167	183	184	176	162	160	213	211	205	204	71978	183	243	139	4283

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA. 02138

K.MENG CHNG
SENIOR TECHNICAL STAFF

RUN 27 AUG 1980
POST OFFICE MODE WIND DIRECTION (DEG)
LEAST SIGNIFICANT DIGIT = 1.0000

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
WDR	78202										265	265	268	269	268	268	272	274	274	275	274	274	277	277	274	72078	277	277	265	4824
WDR	78203	269	273	268	266	266	265	273	268	268	273	268	270	269	266	274	271	272	271	271	272	270	270	267	275	72278	270	275	266	6476
WDR	78204	271	270	271	271	275	275	270	271	271	273	268	269	271	274	269	271	279	273	280	280	287	280	281	271	72378	274	287	268	6571
WDR	78205	273	267	277	296	314	305	298	289	304	304	262	181	155	146	114	94	90	95	90	95	101	90	103	93	72478	193	314	90	4130
WDR	78206	268	267	265	262	269	266	272	265	266	267															72578	267	272	262	2667

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA 02138

FRANK IACOVINO
SENIOR TECHNICAL STAFF

RUN 29 AUG 1980
WIND DIRECTION (DEGREES)
Post Office Roof
LEAST SIGNIFICANT DIGIT = 1.0000

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
WD	80184													188	215	210	204	212	213	214	207	235	226	226	233	70280	215	235	198	2583
WD	80185	212	215	190	238	235	159	192	46	38	89	99	94	99	94	94	81	80	95	75	162	210	228	243	221	70380	146	243	38	3407
WD	80186	277	248	239	238	264	267	281	282	39	59	73	55	79	94	74	87	89	101	111	93	137	138	170	203	70480	152	282	39	3638
WD	80187	218	211	220	264	63	75	183	134	202	185	203	168	149	207	231	188	197	208	217	188	205	179	192	222	70980	188	264	63	4521
WD	80188	234	222	232	267	259	264	275	275	285	272	271	280	289	282	265	270	290	279	297	314	305	295	297	287	70680	277	385	222	6540
WD	80189	273	267	263	256	266	260	257	260	260	290	267	180	270	258	259	275	273	278	60	69	72	104	150	183	70780	221	290	60	5310
WD	80190	203	267	252	225	180	209	210	216	205	194	193	195	190	181	162	183	204	172	167	260	263	267	287	283	70880	215	287	162	5168
WD	80191	282	231	257	278	278	258	288	289	103	68	340	244	291	250	282	138	133	139	266	295	200	74	59	92	70980	214	340	59	5135
WD	80192	73	73	81	47	47	42	66	57	56	84	75	72	67	78	88	87	80	85	82	78	80	130	205	199	71080	85	205	42	2032
WD	80193	191	135	208	206	211	210	185	207	190	209	185	190	195	201	178	182	207	205	194	206	201	191	170	192	71180	177	311	135	4718
WD	80194	193	175	187	256	311	24	330	270	68	56	25	303	305	295	303	279	272	278	271	282	300	11	10	263	71280	211	330	10	5077
WD	80195	206	190	235	240	254	242	243	240	295	272	273	264	217	210	202	170	85	97	83	102	130	181	355	352	71380	211	355	83	5191
WD	80196	340	129	86	270	267	247	266	270	201	284	303	251	209	211	196	218	174	187	111	288	208	190	211	218	71480	222	340	86	5588
WD	80197	204	213	204	214	212	219	223	212	224	216	210	233	240	236	197	214	193	202	211	209	196	188	200	196	71580	211	240	188	5066
WD	80198	192	190	194	210	204	212	195	212	184	202	216	173	186	215	222	219	222	231	191	183	170	201	162	264	71680	202	264	162	4834
WD	80199	219	202	195	214	242	277	235	265	219	190	187	204	186	190	214	190	200	188	195	201	208	190	186	266	71780	211	277	186	5063
WD	80200	273	275	268	247	248	274	277	305	38	49	55	68	74	82	71	84	91	92	85	270	215	202	154	194	71880	166	305	38	5236
WD	80201	190	194	198	207	149	178	203	152	150	196	169	188	197	175	186	179	188	191	190	197	196	184	196	200	71980	188	207	149	4854
WD	80202	180	187	210	195	192	199	201	201	195	179	201	180	171	201	251	252	209	211	254	208	220	195	188	208	72080	201	254	120	4825
WD	80203	198	181	138	202	182	161	230	209	256	215	164	182	192	194	195	219	221	186	217	214	222	181	199	207	72180	197	256	138	4731
WD	80204	202	208	207	68	234	177	195	170	98	116	167	200	195	184	174	180	186	187	189	192	196	188	186	186	72280	179	234	68	4464
WD	80205	195	210	198	215	205	190	190	208	190	167	208	194	191	152	202	172	187	183	186	197	193	145	208	177	72380	190	215	145	4514
WD	80206	209	180	224	188	247	288	297	293	300	263	271	304	343	49											72480	249	343	49	3406

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA. 02138

E.MENG CHNG
SENIOR TECHNICAL STAFF

RUN 27 AUG 1980
POST OFFICE CAFE WIND SPEED (MPH)
LEAST SIGNIFICANT DIGIT = .1000

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
WSC	78191																		76	76	73	66	65	80	73	71078	72	80	65	503
WSC	78192	54	59	58	68	58	43	30	22	31	30	36	60	44	53	62	62	67	58	47	45	35	29	12	9	71178	45	68	9	1072
WSC	78193	16	31	30	40	47	45	53	55	49	46	30	25	35	40	30	31	16	33	38	39	23	12	21	27	71278	34	55	12	820
WSC	78194	40	43	36	44	52	49	55	59	38	25	31	42	53	55	68	63	74	69	70	48	38	50	63	65	71378	51	74	25	1270
WSC	78195	75	68	71	72	69	64	57	54	54	76	77	77	64	73	76	70	74	75	70	77	69	66	69	78	71478	70	78	54	1677
WSC	78196	45	38	49	22	22	22	29	34	20	9	24	49	46	21	23	54	46	26	10	19	19	25	39	8	71578	29	54	8	690
WSC	78197	11	30	5	1	2	6	4	8	7	1	43	51	58	63	71	69	76	72	71	67	67	30	15	17	71678	35	76	1	845
WSC	78198	14	19	37	3	3	9	18	18	14	15	20	22	15	27	20	12	37	47	17	18	4	5	3	3	71778	17	47	3	400
WSC	78199	3	10	25	32	34	32	26	19	8	7	3	8	16	32	55	54	52	57	46	38	36	22	8	18	71878	27	57	3	641
WSC	78200	50	48	38	22	33	36	29	35	39	29	8	42	48	56	57	47	49	46	50	54	56	46	52	58	71978	43	68	8	1083
WSC	78201	56	53	63	63	66	62	56	59	55	47	61	57	74	73	68	71	74	76	79	94	96	84	92	80	72079	60	96	47	1677
WSC	78202	70	73	64	64	68	58	62	60	58	59	55	49													72178	62	73	49	740

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA. 02138

K.MENG CHNG
SENIOR TECHNICAL STAFF

RUN 27 AUG 1980
POST OFFICE CAFE WIND DIRECTION (DEG)
LEAST SIGNIFICANT DIGIT = 1.0000

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
WDC	78191																		299	295	295	299	301	301	300	71078	299	301	295	2090
WDC	78192	302	297	297	299	300	300	298	295	298	309	313	306	303	299	305	304	298	301	301	302	304	318	306	330	71178	304	330	295	7285
WDC	78193	356	290	292	294	301	302	299	298	299	303	297	298	301	304	304	303	47	56	48	65	80	57	57	46	71278	221	356	46	5297
WDC	78194	43	42	42	43	45	46	45	46	46	47	42	42	46	45	39	43	47	45	43	52	52	51	45	40	71378	45	52	39	1077
WDC	78195	44	46	47	46	44	46	44	41	44	46	47	43	45	46	44	43	46	54	46	42	41	50	51	49	71478	46	54	41	1095
WDC	78196	45	39	44	40	36	31	28	38	55	67	52	52	44	56	168	220	224	218	179	211	214	207	227	241	71578	114	241	28	2736
WDC	78197	39	37	54	307	25	35	216	217	216	226	217	219	218	217	224	225	220	216	226	225	222	219	218	229	71678	186	307	25	4467
WDC	78198	231	219	221	218	266	260	253	249	252	256	240	215	229	218	211	213	232	81	84	86	114	153	119	202	71778	201	266	81	4803
WDC	78199	237	249	269	273	271	271	267	268	271	295	272	134	72	88	89	88	86	89	95	92	89	75	96	190	71878	176	295	72	6038
WDC	78200	270	266	269	267	266	265	265	267	268	266	262	269	270	267	269	270	264	270	273	269	270	272	282	270	71978	269	282	262	6446
WDC	78201	266	275	274	266	265	265	263	265	268	268	268	267	277	269	270	268	265	268	263	262	260	267	273	264	72078	267	277	260	6416
WDC	78202	262	268	263	265	270	271	272	264	269	270	268	264													72178	267	272	262	3406

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA. 02138

L.MENG CHNG
SENIOR TECHNICAL STAFF

RUN 27 AUG 1980
ARCH STREET WIND SPEED (MPH)

LEAST SIGNIFICANT DIGIT = .1000

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
WSA	78188																	27	25	42	34	35	32	28	34	70778	32	42	25	257
WSA	78189	31	35	33	37	31	28	30	31	37	31	36	34	37	34	31	33	26	29	29	23	25	22	24	24	70878	30	37	22	731
WSA	78190	31	23	24	26	25	24	21	22	34	23	21	29	31	29	23	25	33	25	26	29	25	22	23	19	70978	26	34	19	613
WSA	78191	24	19	18	20	19	19	21	20	23	20	27	28													71078	22	28	18	258
WSA	78192										37	44	33	36	34	36	33	30	21	27	27	26	21	19	21	71178	30	44	19	445
WSA	78193	24	21	22	22	25	22	25	21	19	24	23	17	24	18	24	19	25	24	27	27	22	20	21	21	71278	22	27	17	537
WSA	78194	24	25	26	23	17	16	18	19	18	24	24	28	22	24	22	24	25	29	37	27	21	20	22	21	71378	23	37	16	556
WSA	78195	25	25	21	21	30	17	21	18	24	32	30	25	28	30	34	31	23	21	16	19	30	20	16	13	71478	24	34	13	570
WSA	78196	17	16	22	21	18	16	24	22	18	18	19	16	22	19	23	23	24	29	21	22	18	19	21	21	71578	20	29	16	489
WSA	78197	24	25	19	18	20	23	22	20	22	24	24	20	21	23	27	32	27	21	16	16	18	21	18	25	71678	22	32	16	526
WSA	78198	15	18	21	16	18	29	26	33	16	17	17	20	22	25	23	19	22	26	22	22	20	24	21	23	71778	21	33	15	515
WSA	78199	20	20	23	21	23	19	21	20	24	20	21	20	17	21	21	20	25	23	23	24	25	22	23	23	71878	22	25	17	519
WSA	78200	23	21	18	15	17	19	18	17	20	24	32	37	36	42	33	36	30	29	24	26	20	23	28	27	71978	26	42	15	615
WSA	78201	21	17	15	19	25	28	23	22	19	22	24	28	35	30	26	32	30	20	15	26	23	19	23	25	72078	24	35	15	567
WSA	78202	26	20	25	22	21	18	19																		72178	22	26	18	151
WSA	78206										19	22	22	23	21	20	21	22	20	24	25	23	26	23	22	72578	22	26	19	303
WSA	78207	25	22	16	15	17	20	18	15	19	19															72678	19	25	15	106

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA 02138

FRANK IACOVINO
SENIOR TECHNICAL STAFF

RUN 29 AUG 1980
WIND SPEED (MILES/HR)
Arch Street
LEAST SIGNIFICANT DIGIT = .1000

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
WS1	80189										44	65	79	69	53	55	54	46	44	30	23	8	5	13	6	70780	40	79	5	594
WS1	80190	19	26	9	31	17	10	8	33	33	40	67	60	61	61	66	73	40	36	68	71	48	33	41	7	70880	40	73	7	958
WS1	80191	6	14	29	13	17	29	41	39	31	70	70	67	83	61	83	89	67	63	71	53	36	22	15	25	70980	46	89	6	1099
WS1	80192	36	7	13	53	60	46	55	61	50	39	58	66	64	63	53	100	77	43	53	52	35	14	7	26	71080	47	100	7	1131
WS1	80193	57	31	65	52	49	52	53	51	63	80	62	77	74	67	79	81	80	81	93	86	67	77	40	43	71180	65	93	31	1560
WS1	80194	70	49	23	32	30	73	51	49	73	73	54	51	98	63	75	61	82	56	53	47	49	40	40	41	71280	56	98	23	1333
WS1	80195	37	32	33	50	43	57	32	36	42	68	59	47	69	66	66	69	65	32	26	11	3	13	32	29	71380	42	69	3	1017
WS1	80196	21	8	20	30	32	26	30	24	39	45	63	52	69	53	83	66	54	49	32	29	37	36	45	51	71480	41	83	8	934
WS1	80197	65	46	22	34	35	40	24	78	73	51	55	70	95	126	83	70	75	64	48	63	54	53	59	59	71580	60	126	22	1442
WS1	80198	56	60	64	48	39	38	20	66	59	72	84	62	47	55	51	75	60	43	40	36	44	30	47	65	71680	53	84	20	1261
WS1	80199	50	19	33	33	52	34	38	38	51	58	37	95	48	65	55	76	57	60	63	89	49	52	61	54	71780	53	95	19	1267
WS1	80200	47	35	34	26	51	15	45	52	60	67	46	42	66	54	41	52	25	38	48	35	15	41	47	47	71880	43	67	15	1079
WS1	80201	46	55	43	44	66	74	38	58	56	74	73	62	54	92	81	58	64	49	55	40	53	49	28	37	71980	56	92	28	1347
WS1	80202	63	41	56	63	67	62	37	56	62	64	68	82	70	85	108	81	71	63	57	49	79	58	73	72	72080	66	108	37	1595
WS1	80203	67	43	43	53	37	25	55	46	38	57	44	70	66	50	72	67	76	71	82	79	85	58	57	78	72180	59	85	25	1416
WS1	80204	58	85	55	50	34	47	53	52	71	85	57	63	87	104	81	78	78	95	78	64	64	69	86	74	72280	70	104	34	1668
WS1	80205	95	117	50	51	79	46	59	83	78	55	73	103	80	70	66	58	45	39	44	80	55	28	30	54	72380	64	117	20	1573
WS1	80206	69	33	24	34	39	54	62	73	72	77	83	58	53	64	57	54	66	49	55	44	47	24	25	34	72480	52	83	24	1250
WS1	80207	66	62	55	50	48	30	42	45	47	38	63	51	62	70	65	76									72580	54	76	30	800

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA. 02138

K.MENG CHNG
SENIOR TECHNICAL STAFF

RUN 27 AUG 1980
ARCH STREET WIND DIRECTION (DEG)
LEAST SIGNIFICANT DIGIT = 1.0E+0

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
WDA	78191												45	150	145	145	145	171	138	184	173	176	145	87	114	71078	144	188	45	1663
WDA	78192	110	80	80	98	78	75	74	74	70	120	173	173	166	164	166	163	156	161	169	167	177	177	172	168	71178	134	177	70	3371
WDA	78193	181	275	286	292	293	293	289	289	280	180	166	173	182	171	167	168	166	161	162	162	179	151	151	184	71278	200	293	151	5091
WDA	78194	156	228	279	141	141	130	168	253	263	273		269	247	246	242	284	22	28	271	232	250	245	227	265	71378	211	284	22	4800
WDA	78195	270	252	335	273	220	237	280	247	237	220	224	223	225	226	223	221									71478	245	335	220	3813
WDA	78200										224	225	237	236	241	237	240	237	243	236	235	284	267	233	251	71978	242	284	224	3626
WDA	78201	240	238	231	356	260	258	261	252	267	33	8	330	254	237	236	291	81	21	21	19	15	12	10	9	72078	164	356	8	3940
WDA	78202	8	9	6	9	9	9	8	11		227	264	10	13	11	14	1	18	237	288	255	265	261	276	270	72178	108	288	1	2477
WDA	78203	259	262	238		257	254	253	248	251	236	212	219	202	220	1	246	233	332	199	212	172	187	300	261	72278	229	332	1	5260
WDA	78204	293	222	44	241	227	230	235	189	255	222	222	225	224	224	225	226	229	231	221	240	227	22	3	364	72378	206	293	3	4911
WDA	78205	266	35	30	42	67	68	43	74	17	13	15	15	15	14	15	4	357	333	344	280	263	215	211	209	72478	122	357	4	2906
WDA	78206	225	254	238	225	206	208	196	195	205	208	116	125	172	190	178	131	155	195	216	218	220	217	328	239	72578	203	328	116	4060
WDA	78207	250	247	217	295	212	304	103	265	233	209															72678	234	304	103	2305

BOLT BERANEK AND NEWMAN INC.
50 MOULTON STREET
CAMBRIDGE, MA 02138

FRANK IACOVINO
SENIOR TECHNICAL STAFF

RUN 29 AUG 1980
WIND DIRECTION (DEGREES)
Aron Strout
LEAST SIGNIFICANT DIGIT = 1.0000

PID	YRDAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MMDDYY	DA	HI	LO	TOTAL
WD1	80189										252	251	277	69	62	66	73	68	71	29	263	271	273	284	298	70780	174	298	29	2607
WD1	80190	277	278	273	274	272	295	293	291	286	284	252	280	299	317	326	318	297	269	244	299	357	344	351	352	70880	297	357	244	7123
WD1	80191	293	266	266	271	312	342	352	348	347	347	350	350	273	250	249	242	246	243	245	241	243	244	244	268	70980	285	352	241	6832
WD1	80192	281	271	282	341	344	332	325	316	318	308	244	269	19	19	13	303	243	249	17	342	264	270	272	293	71080	247	344	13	5935
WD1	80193	274	265	273	268	256	266	274	257	253	251	257	252	251	250	239	245	250	260	261	262	251	255	255	280	71180	259	280	239	6205
WD1	80194	258	260	255	263	129	94	87	85	87	91	89	84	86	85	88	87	84	86	83	88	87	87	281	271	71280	133	281	83	3195
WD1	80195	272	273	272	273	275	271		297	86	87	87	84	82	80	81	88	88	71	270	269	272	269	272	271	71380	191	297	71	4390
WD1	80196	271	273	274	269	262	259	261	255	251	257	250	254	251	245	249	246	247	248	250	274	277	261	245	247	71480	257	277	245	6170
WD1	80197	274	260	272	273	272	269	270	255	249	252	252	255	249	250	249	243	248	253	256	255	252	252	260	263	71580	260	274	243	6183
WD1	80198	255	248	249	253	261	267	255	240	247	251	255	256	250	252	255	244	241	245	252	248	254	250	251	252	71680	251	267	240	6091
WD1	80199	251	253	253	254	254	255	249	248	249	247	239	246	252	250	251	251	249	266	261	241	246	255	252	251	71780	251	266	239	6029
WD1	80200	255	265	256	251	252	251	139	77	76	71	65	271	250	246	283	254	271		267	248	249	250	247	250	71880	219	283	65	5014
WD1	80201	251	247	248	250	252	258	253	247	247	252	250	253	249	244	248	248	250	243	244	244	244	241	245	247	71980	248	258	241	5948
WD1	80202	250	266	270	268	255	248	260	268	262	255	245	242	246	250	250	246	246	250	247	249	244	241	239	248	72080	252	270	239	6048
WD1	80203	252	250	254	277	273	274	271	272	271	255	246	250	262	244	244	243	246	250	254	253	256	248	249	265	72180	256	277	243	6149
WD1	80204	254	260	265	259	256	253	249	251	247	240	238	240	243	240	243	247	250	252	251	245	246	247	251	250	72280	247	265	238	5917
WD1	80205	248	251	256	253	249	251	255	258	257	254	253	254	252	250	254	254	257	262	260	253	251	253	256	254	72380	254	262	248	6078
WD1	80206	249	238	245	246	106	100	103	107	98	64	63	61	59	250	248	251	3	5	5	6	346	273	270	263	72480	152	346	3	3659
WD1	80207	98	106	102	96	110	110	108	104	116	120	120	107	92	266	246	251									72580	135	266	92	2152

Central Business District B65R D.C.E

Downtown Crossing

Bolt, Beranek and Newman Inc
Air Quality, Noise and Wind
Measurements December 1980

Central Business B65R D,C.E.
Downtown Crossing